THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXIX. No. 723.] LONDON, MARCH 20, 1877. [29TH YEAR.] Price 6d.

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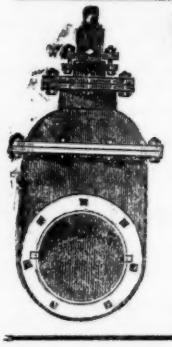
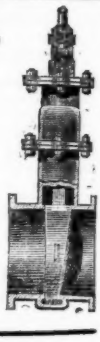


C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

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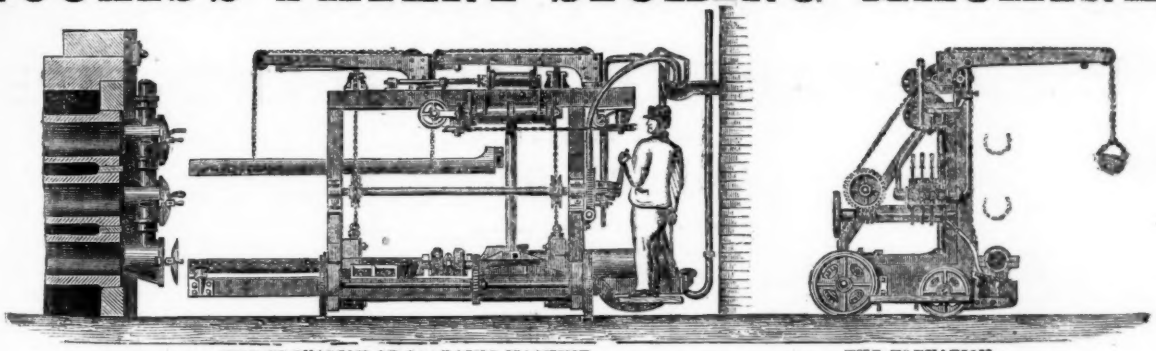

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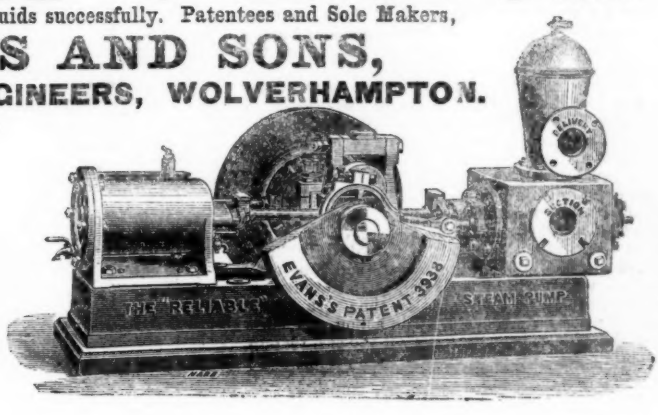

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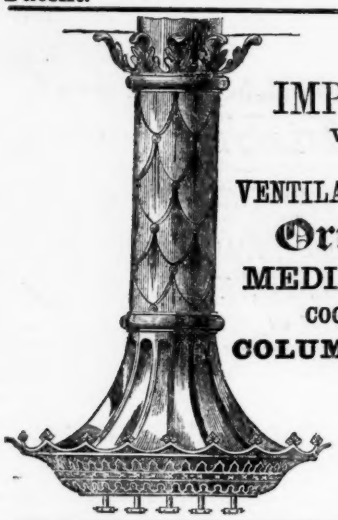

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This removable Service or Stand Pipe is suitable for lighting markets and other places, for taking pressures, or for any purpose where only occasional or periodical additional public lights or connexions are required.

The apparatus consists of a vertical pipe, the lower end of which is fixed to the main or collar, and the upper end to a box like a common syphon-box. Into this box is fastened a plate having a plug or valve thereon. The valve or barrel is fitted to a fixed seat or plug capable of turning upon it, and is square on the outside, and of such size as to fit a collar made to slip over it, the joint between the collar and the plug being made gas-tight by the former being forced down upon an india-rubber washer, by certain projections coming in contact with other projections formed in the interior of a cap or cover which surrounds the valve and collar before described. The top of the cover has a round hole with a notch or key-way on its opposite sides to admit of the projections or feathers on the collar passing through and on to the plug. To the collar is fixed the stand or service pipe, which is provided with an ordinary stopcock and gas-burner or pressure-gauge at its upper end. The action of the apparatus is simple. When it is desired to make the attachment, a service or stand pipe furnished with a collar, as described, is thrust down through the cap or cover, and, on being turned, will fix or jam itself tightly, so as to remain firmly upright, and at the same time turn on the gas from the main beneath. The action of removing the pipe effectually shuts off the gas, thereby ensuring great security against fraud, and loss by leakage.

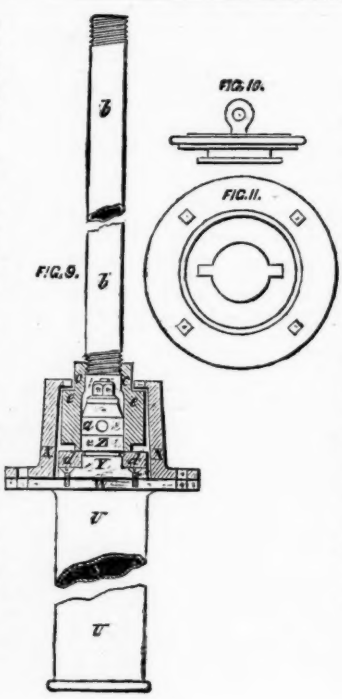

FIG. 10.

FIG. 11.

Fig. 9 represents the arrangement for the attachment of removable market or other gas stand-pipes. The view is a side elevation and part section. To the top of the service, U, is fixed a plate, W, and upon that is fastened by bolts the case or box, X. To the plate, W, is also fixed, by screws, the plug or valve, Y, and upon this plug the barrel Z is free to turn. That part of the barrel marked *a* is square. The stand-pipe, *b*, has attached to its lower end the collar, *c*, which is square in the interior, so as to slip over and turn the barrel by the square part, *a*, until the hole in the plug and that in the barrel coincide, when a gas-way will be established between the service, U, and the stand-pipe, *b*. A gas-tight joint between the collar, *c*, and the plate of the plug or valve, Y, is made by the former being forced down upon an india-rubber washer, *d*, by the upper part of the feathers, *e*, of the collar, *c*, coming in contact with inclined projections cast on the inner side of the box, X.

Fig. 10 is a plan of the top of the box or case containing the valve.

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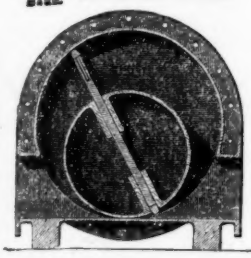

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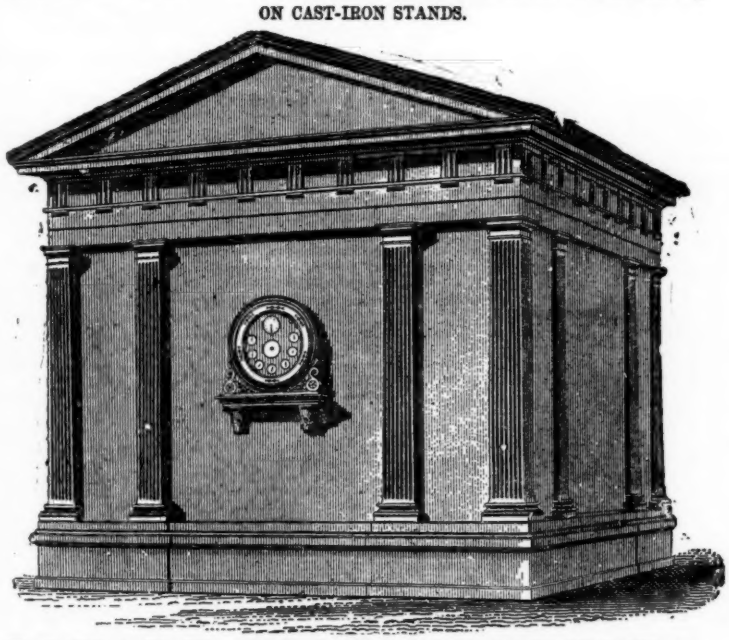

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BELGIAN CLAY RETORTS.
J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.
Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

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DEPÔT for STOURBRIDGE AND NEWCASTLE
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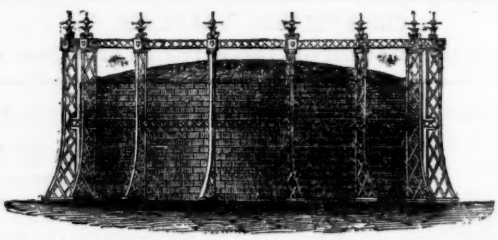
AND ALL MATERIALS FOR GAS MANUFACTURE AND DISTRIBUTION.



THE HORSELEY COMPANY,
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Steam-Jet Engineers,
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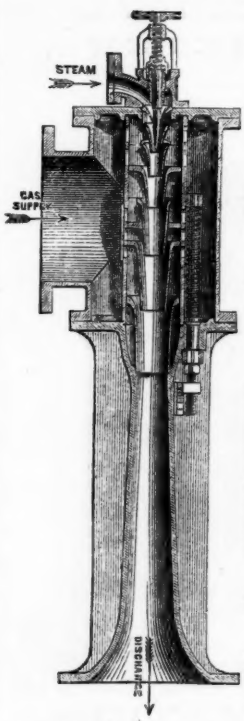

E. KÖRTING'S PATENT
STEAM-JET GAS-EXHAUSTER.
IMPROVED CLELAND'S PATENT.
Small Cost—Compactness—Perfectly Self-Acting—
Self-Regulating—Self-Cleansing—No Steam-Engine—No Attention—
No Extra Room Required—No Wear and Tear—No Noise—
No Oscillation in Vacuum, or Back Pressure.
UPWARDS OF 200 IN USE.
SUPPLIED TO—

Chartered Gas Co.	Glasgow Corporation.	Hanna, Donald, and Wilson, London.
London Gas Co.	Leyland Gas Co.	Ratcliff Gas-Works.
S. Metropolitan Gas Co.	Stalybridge Gas-Works.	Kendal Gas-Works.
Phœnix Gas Co.	Lincoln Gas-Works.	Longton Gas Co.
Liverpool Gas Co.	Birmingham Gas-Works.	Dartford Gas Co.
Bolton Corporation.	Wakefield Gas-Works.	Exeter Gas Co.
Horsham Gas Co.	Brentford Gas-Works.	Harrogate Gas Co.
Epsom and Ewell Gas Co.	Burnley Gas-Works.	Hertford Gas Co.
Ipswich Gas Co.	Guildford Gas-Works.	Waterside Gas-Works, Todmorden.
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Sandwich Gas Co.	Kirkintilloch Gas-Wks.	
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&c., &c., &c.

E. KÖRTING'S PATENT STEAM-JET REVIVIFYING BLOWERS FOR THE PURIFYING MATERIAL.
SOLE LICENSEES FOR
W. CLELAND'S PATENT STEAM SCRUBBER AND SLOW-SPEED CONDENSER.
FOR PARTICULARS, APPLY TO
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OR TO
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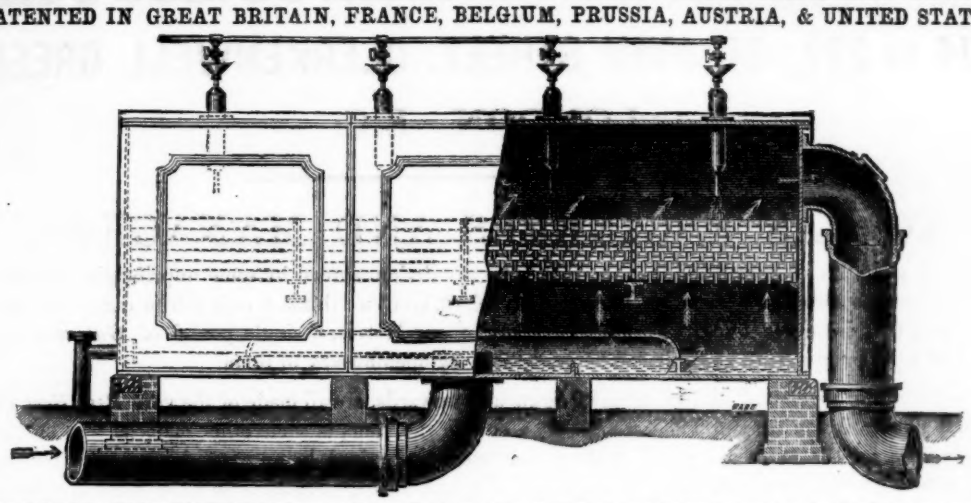
LONDON,
SOLE AGENT FOR ENGLAND AND WALES.

GAS PURIFICATION.

SAVILLE'S SELF-DISTRIBUTING GAS SCRUBBER-WASHER.

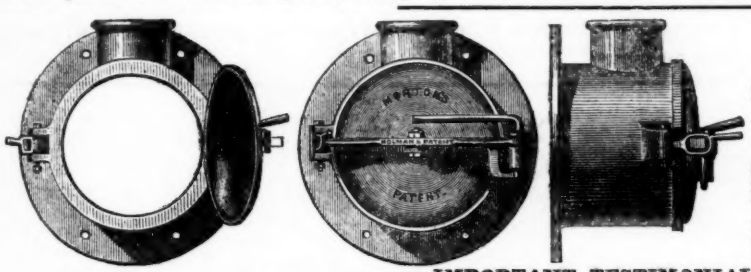
PATENTED IN GREAT BRITAIN, FRANCE, BELGIUM, PRUSSIA, AUSTRIA, & UNITED STATES.



MECHANICAL ARRANGEMENT.—The Washer Tank contains a large bottom chamber, into which the Gas is freely admitted through an ordinary full-way inlet-pipe, passing first under an inverted vessel which removes any Tar remaining in the Gas after leaving the Condenser; it then rises slowly over the whole surface, CONTAINING AN AREA OF ABOUT EIGHT TIMES THAT OF THE INLET-PIPE, through equidistant spaces in a series of Self-Sealing Water Troughs, arranged in tiers, dividing itself and passing through the various dips until it reaches the upper chamber, and from thence through the outlet-main. The washing liquid being CLEAN WATER is admitted by the Syphon inlets on top of Tank to the upper row of troughs, running through each successive tier, and becoming impregnated with the impurities extracted from the Gas, gaining strength at each dip on its descent, and finally passing off by the outlet syphon at the bottom. It will be observed that in this Scrubber-Washer the Gas comes first in contact with THE STRONGEST LIQUOR at the bottom, and passes through WEAKER LIQUOR at each successive tier, until it issues through CLEAN WATER into the upper chamber; hence the true principle of Gas Purification by Washing is simply and automatically effected.

ADVANTAGES.—Great economy in first cost and foundations; great saving of other purifying apparatus and material; occupies little space, and stands only a few feet in height; being entirely self-acting, requires no motive power either for purifying or distributing; the Gas is washed several times in ONE vessel, each time in liquor of a different strength, ultimately passing through CLEAN WATER; produces liquor of any required strength by once passing through; can be fixed (if desired) at any elevation to permit Contractors' tanks being filled without the expense of pumping.

One of these Scrubber-Washers has been in successful operation for the past twelve months at the Sowerby Bridge Gas-Works, and they are now being erected at the Corporation Gas-Works, Adderley Street, Birmingham, and at the Phœnix Gas-Works, Vauxhall, London.



MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

HOLMAN'S NEW PATENT BRACKETED CROSS-BARS, ANTI-FRICTION CATCHES AND ECCENTRIC FASTENINGS.

Instantaneous Sealing effected. No Luting. No Duplicate Lids required. Holman's New Self-Sustaining Cross-Bar ensures freedom of joint and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), nearly 25,000 being in use at various Gas-Works in London and the Provinces.

IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (commonly called the Chartered Gas Company), Beckton, North Woolwich, July 2, 1874.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them. I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly, (Signed) G. C. TREWBY.

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

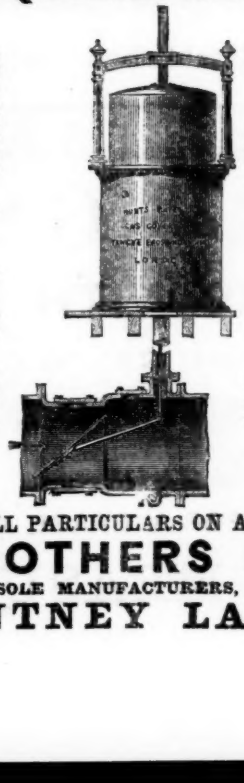
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION TO

TANGYE BROTHERS & HOLMAN,

SOLE MANUFACTURERS,

LAURENCE POUNTNEY LANE, LONDON, E.C.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

TO GAS ENGINEERS AND MANAGERS.

It having come to our knowledge that a report is in circulation, spread by some unprincipled person or persons, that the cases of our larger-sized Meters are made of Galvanized Iron, we think it only fair to ourselves, and just to our customers, to say, that we never have used, in making any of our Meters, a single pound of *Galvanized Iron*, or any other *cheap* and *inferior material*, and this can be easily seen by opening any of them.

The cases of our large-sized Meters, from 20 lights and upwards, are all made of the very *Best Best Patent Alloy*, which is nearly double the price, and will last more than double the time, of some other material that has been and still is very largely used for the same purpose. And our experience, acquired by an extensive use of it for upwards of 30 years, enables us to say with confidence that no other metal in use for the purpose is so little liable to corrosion from the action of the gas.

We have now in use a Meter made in 1848, and therefore 29 years old, the case of which is made of Patent Alloy; the Meter is still in perfect order, and shows no signs of decay.

The utmost care is exercised by us in selecting none but the very best materials for all parts of our Meters; much of it is made *expressly for us*, as it is not possible to obtain it in the open market of the same superior quality.

The great fall in the price of all materials used in making our Meters has enabled us to give an increased discount, thus giving our customers the benefit of the fall. This we were bound in fairness to do, as we raised the price of our Meters four years ago, when the price of all metals went up.

It will be our constant endeavour, by using none but the best materials, and employing the most skilful workmen, to maintain the high character our Meter has hitherto borne.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

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TO CORRESPONDENTS.

CANTOR LECTURES.—*Mr. A. Vernon Harcourt's Lectures on the "Chemistry of Gas-Making," now in course of delivery at the Society of Arts, will be reported in the* JOURNAL. *The first lecture is in type, but its publication is unavoidably postponed.*

N. S.—*Your letter received. We are obliged by the suggestion.*

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 20, 1877.

Circular to Gas Companies.

THE Committees of the House of Commons who have Gas Bills under their consideration, are proceeding with some alacrity. The Longton Corporation Bill has already been passed. It is, as our readers have been informed, a Purchase Bill, the terms of purchase having been arranged between the Company and the Corporation. Thus one more Gas Company disappears. The consideration is to be the payment of a gross sum of £73,150 in cash. The paid-up capital of the Company is £40,000, one-half of which is entitled to ten per cent., and the other half to seven per cent. At this rate the undertaking must be considered as decidedly cheap, and the Corporation may be congratulated on its acquisition. The prospects are exceedingly good, for the district is improving, and the demand for gas increasing.

The Bill by which the Ramsgate Local Board seek to make a compulsory purchase of the Isle of Thanet Gas Company occupied the attention of a Committee three days last week, but we are compelled to defer a report of the evidence. When the Committee rose on Friday, the Chairman expressed a hope that before they met again (yesterday) the contending parties would have come to some agreement. At the time we are writing, we have no knowledge that an agreement has been arrived at, and, frankly speaking, we do not see how one could be come to, unless the Company surrender at discretion. We shall, perhaps, learn more before we go to press. It may be said, however, that the terms of purchase offered by the Local Board are by no means bad, taking everything into consideration, still, no company in a good position like to be snuffed out, as it were. There is, we rather think, no other Gas Company situated exactly as the Isle of Thanet Company, but there are some non-statutory Companies growing into a like case, and if these will take our advice, they will lose no time in clothing themselves with the most recent parliamentary powers, and subjecting themselves to the most recent statutory regulations. We shall say no more of Ramsgate until the fate of the Company is decided. The Committee, while refusing to express any opinion on the merits of the several Bills before them, evidently think that an arrangement may be made. There can be but one, and that will be come to or declined before these lines see the light.

[We learn that, on the meeting of the Committee yesterday morning, it was stated that the Local Board had offered the Company £110,000 for their undertaking. The Company, however, declined to sell at this price, and the proceedings before the Committee, therefore, continued.]

When attending the Committee on this Bill on Thursday last, we noticed one circumstance which really calls for remark. The Gas Company are supposed to be represented by three counsel, and, as a matter of course, pay their fees. But, on the day we have named, the learned gentleman who was cross-examining the principal witness for the Local Board was stopped in the middle of a question, and called to another committee-room, and thereafter, during the re-examination of the witness, and for some time after, the Company were absolutely unrepresented by counsel, not one of the three being in the room. It might not have been a matter of very much consequence, and we have to admit that the Local Board were but little better represented. They have four counsel engaged, but only one was present at the time we speak of.

The Committees of the Lords were to commence yesterday with the Blackburn Bill, which aims at confiscating the undertaking of the Blackburn Gaslight Company. In this case, we believe, no terms have been proposed, and the Bill, if successful, will leave them to be settled by arbitration, under the provisions of the Railway Clauses Consolidation Act, 1847.

In another column our readers will see that an agreement has been come to between the Corporation of Clitheroe and the Clitheroe Gas Company, by virtue of which the undertaking of the latter will be transferred to the former. The terms cannot be considered illiberal. The Corporation agree to pay £437 10s. in satisfaction of arrears of dividends, and a bonus of £2887 to ordinary shareholders, in consideration of uncalled-up capital, and annuities equal to maximum dividends on all classes of shares; the Corporation, of course, assuming all the mortgage debt from the date of the transfer. Regretting, as we always do, the extinction of a Gas Company, we feel bound to say that the Directors of this Company would have made a mistake if they had not agreed to the terms now settled.

Mr. Chamberlain, now M.P., not content with buying up the Gas and Water Companies supplying Birmingham, has sought authority to purchase all the public-houses in the borough. His really philanthropic purpose has unfortunately received a check, and the Gottenburg system will remain peculiar to Sweden, the population of which are, perhaps, the hardest spirit-drinkers in the world. We have nothing, however, to say to that. We refer to the matter simply to quote the opinion expressed by a daily metropolitan newspaper, supporting Liberal politics, to the following effect:— "It is ever odious to the spirit of true "Liberalism to vest trading rights in incorporated monopolies. "Indeed, nothing but the clearest demonstration of imperative "public necessity would justify an acceptance of any scheme "that so flagrantly violated the first principles of a sound com-"mercial policy." Now a Gas Company, with statutory powers, is, of course, an incorporated monopoly up to a certain point; but a corporate gas undertaking is a real and absolute monopoly. The public inconveniences of competition in the supply of gas are very great, but the first principles of a sound commercial policy are as flagrantly violated when the monopoly is conferred on a Corporation as when it is granted to a Company.

The Bristol United Gas Company had, we are happy to say,

a very pleasant half-yearly meeting last Thursday. The directors were able, while proposing maximum dividends, to announce a reduction of threepence per 1000 feet in the price of gas, making it now 3s. 3d. per 1000 feet. No doubt the continued prosperity of the Company will soon attract the cupidity of the Corporation, who will endeavour to absorb the undertaking as they are now absorbing the Water Company. For the present, however, the Gas Company are not harassed. We notice with satisfaction that the salary of the Secretary has been raised from £600 to £800 per annum. This "princely" remuneration has been earned by forty years of faithful service. When Mr. Townsend entered on his duties, the two Gas Companies supplying Bristol made daily, on the average, 60,000 feet of gas; to-day an average of three and a half millions are supplied. The price at the same distant time ranged from 7s. to 12s. per 1000 feet; it is now, as stated above, 3s. 3d. per 1000 feet. What a record of progress is contained in these few simple figures!

When noticing, a fortnight ago, the sales of shares by auction by the Dover Gas Company, we overlooked the fact which had, indeed, escaped our memory, that by section 22 of that Company's Act, 1860, the sale of new shares by auction is made compulsory. Curiously enough, this provision of the Act reverses the ordinary course of practice, for the 25th section provides that any shares not purchased at the public auction shall be allotted *pro ratâ* among existing shareholders. At the present day, shareholders have small chance of an allotment, unless they go into the open market.

Where there is nothing of general public interest going on in Swansea, and the reporters of a local print accordingly have leisure, they are, we believe, usually set to write letters attacking the Gas Company. There is nothing novel in this fictitious correspondence, and, perhaps, the JOURNAL OF GAS LIGHTING may be the only paper in existence that can boast that no anonymous correspondence was ever concocted in the office. Be that as it may, the Swansea print has succeeded in goading that gentleman of many J's, Alderman John Jones Jenkins, into once more trying to persuade the Corporation of Swansea to start competing gas-works, or to purchase the undertaking of the Swansea Gas Company. It is only fair to say that the majority of the Town Council, while assenting to the resolution proposed by J. J. J., are not at all disposed to harass the Gas Company. They recognize the fact, that the Council have enough on their hands already. They have sewage-works in progress, which will cost £80,000. They have water-works also in progress, which have already cost £160,000, and now a gap in an embankment has been discovered, which it will probably cost £60,000 to fill up. Under such circumstances, we candidly recommend the Gas Company to follow their own course, to keep up the quality of the gas, to reduce the price to the lowest possible limit, and to pay no regard to anonymous correspondence or threatening resolutions in the Town Council.

A terrible explosion at Brighton, happily unattended with loss of life or personal injury, makes a brief allusion to steam-rollers necessary. The effect of these on gas-mains has been disastrous. We rather think the Liverpool United Company first suffered; but we forget whether any explosions followed from the fracture of the mains. In London we have had one explosion lately, attended with fatal effects, which clearly resulted from the fracture of a main caused by a steam-roller. If these ponderous engines are to come into general use, all gas-pipes must be laid much lower beneath the surface than they are at present. It is out of place in our "Circular;" but we feel bound to protest against the use of these fifteen-ton rollers. That they make smooth the rugged way, caused when a Local Authority spread, three and four inches deep, fragments of granite from two-and-a-half to three inches cube, and to pass over which, in a loose state, is calculated to give pain to horses, is indubitable. But at what expense is the smoothness gained? The granite is simply ground to powder, and we believe that an enormous loss is incurred by the use of the steam-roller. Regent Street has just been relaid and rolled in, for the benefit of the horses of the aristocratic spring and summer frequenters; but if we have, as we had last year, a day or two's heavy rain, Regent Street will be ankle-deep in mud, and half the new material will be carted away by the mud contractors. It would, we believe, be much cheaper if the granite were broken smaller, and the roads smoothed by the ordinary narrow-wheeled traffic. Our attention has, we may say, been called more particularly to this matter by the experience of the Corporation of Swansea, who have indulged in the luxury of a steam-roller, and now pay £2000 a year more for the repair of the streets than they did before they bought and used the roller.

If Mr. Yeomans, the Town-Clerk of Sheffield, has a fault, it evidently consists in his being over-zealous. In 1870, or rather in November, 1869, he, without any authority from the Town Council, issued the necessary notices preliminary to the promotion of a Bill, by which power was sought to effect a compulsory purchase of the Sheffield Gas and Water Companies. Steps were soon taken by the Water Company to restrain the Town Council from expending corporate funds in the promotion of a Bill in Parliament. In the end the question came before the Court of Queen's Bench, and the judges unanimously decided, that as the law then stood, a Corporation had no power to expend public funds on a parliamentary contest. The Town Council, however, having adopted Mr. Yeomans's proceedings, persevered with their Bill, but suddenly withdrew it, when it came before a Committee of the House of Commons. In the meantime heavy costs had been incurred, and the payment of such as could not be deferred, was made by the Town-Clerk out of his own pocket. In this way it would appear that he disbursed £7600 of his own money. The question had previously arisen, who was to bear the expenses, and three Town Councillors had become guarantors for the repayment of the money advanced by the clerk. When, however, that unlucky functionary sought to realize his guarantee, the guarantors repudiated. The injustice of this proceeding was recognized by the Town Council, who agreed to levy a "voluntary" rate to raise the money. Being "voluntary," however, most of the ratepayers declined to pay it, and in the end it produced only £2500, leaving the unfortunate clerk still over £5000 out of pocket. In the meantime he has been sued at law, driven into the Bankruptcy Court, and is now practically a ruined man. That is the story which Mr. Yeomans told with "much emotion" to the Town Council of Sheffield at their last meeting. It is a caution to all Town-Clerks; but the like can never happen again. Our readers will remember that the Municipal Corporations (Borough Funds) Act, as originally drawn, was designed to meet this very case, for it provided that the ratepayers money might be expended in the payment of costs incurred within three years anterior to the passing of the Act. The House of Commons, however, refused to pass the Bill with this provision, and hence Mr. Yeomans's tears. We may mention that the story was brought out by a proposal to raise the clerk's salary, so as to give him five per cent. interest on the debt owing to him; and that it is further proposed to insure his life, so that his family may not in the end suffer from his unselfish determination to support the credit of his borough. It is hardly necessary to say that the Gas and Water Companies were freely abused in the course of the discussion; but they are used to this in Sheffield.

Mr. J. Glaisher, F.R.S., the eminent meteorologist, and chairman of the Harrow Gas Company, is a decidedly practical man. We commend his remarks, reported in another column, to the notice of Gas Managers, who, with a little trouble, and at small expense, may often remove the cause of the complaints made. It happened to us once to walk about a town with an inspector who carried a stock of nipples, and in the course of the evening several complainants were satisfied that the fault was not in the gas.

We may briefly call the attention of Gas Examiners and Managers to a paper which we publish to-day "On the Volu- "metric Estimation of Sulphur and Ammonia in Illuminating "Gas." The name of one of the authors, Dr. B. Silliman, is sufficient to stamp it as of value. Volumetric processes possess many advantages when followed by competent experimenters, but offer many sources of error to inexperienced and careless operators. We have no doubt that Dr. Silliman's plan may be followed with advantage.

Water and Sanitary Notes.

ALONG with the gas-works, the Corporation of Clitheroe are about to acquire the undertaking of the Clitheroe Water Company. The consideration in this case must also be considered liberal. Annuities of ten per cent. will be paid on both old and new shares, together with a cash bonus of £4000 in satisfaction of back dividends on original shares. We have nothing to say against such terms, which are, however, no more than just. The Clitheroe Corporation acquire two excellent properties, which we hope they will work to the profit of the town, not in the ordinary pecuniary sense of the word, but to the advantage of the inhabitants in many respects.

The Corporation of Reading, under compulsion to keep their unpurified sewage out of the Thames, have acquired lands, on which they intended to establish sewage farms. Unfortunately, however, it has turned out that the greater part of the land is liable to be flooded, and since water irrigation by overflows from the Kennet, and irrigation with sewage from the town, are

incompatible, the Town Council are placed in a difficulty. The recent floods have been exceptionally high—the highest, it is said, known for fifty-seven years; still, the liability of the land to submergence obviously renders it an unfit site for a sewage farm. It seems strange that this danger was not known before the land was acquired. Floods in the Thames Valley have been frequent enough of late years. We fear this will add one more disastrous failure to the number of bad speculations made by Corporations to rid themselves of the sewage difficulty.

We publish to-day Dr. E. J. Mills's annual report on the chemical quality of the Loch Katrine water supplied to Glasgow. It will be seen that, from a washerwoman's point of view, the water is excellent; but, to our taste, it is singularly vapid, and we are not at all surprised that the Glasgow artizan gives a flavour to it by the addition of "wusky." We do not know why a report on the quality of the Gorbals supply is not given, especially as we may assume that it will soon be extended.

We hear rumours, to which, however, we give but little credence, that the question of a lake supply for the Metropolis will soon be brought forward again. Undoubtedly, before many years are over, it will be necessary to add to our present sources of supply. Parliament, we may take it for certain, will not give permission to pump more than is now allowed from the Thames. We have, however, in the chalk districts around London sufficient resources for long years to come, even if the Metropolis continue to grow at its present rate, and grand as the ruins of that mighty aqueduct, which brought water from Windermere to London, might be to the expected New Zealander, we believe that common sense will prefer to draw from humble wells rather than to expend some millions to immortalize an engineer.

We see that Dr. Frankland has added the supply of the Colne Valley Company to the list of waters he examines. At present they soften their water by Clark's process, but as their business increases—and they have a splendid prospect before them—they will get tired of this practice, and none but laundresses and the lovers of filthy tea will regret the discontinuance.

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, MARCH 12, 1877.

LOCAL GOVERNMENT OF THE METROPOLIS.

Earl DE LA WARR moved for a return of sums expended by vestries and district boards within the metropolitan district, exclusive of the City of London, upon paving, lighting, drainage, water supply, sanitary arrangements, and other works not under the jurisdiction of the Metropolitan Board, during the years 1874, 1875, and 1876. After referring to the recent debate on the question raised by Earl Camperdown, on a reform in the constitution of the Metropolitan Board, the noble earl said the subject to which he wished to call attention involved many interests, and could not be approached without awaking a certain amount of prejudice, as touching upon what might be considered ancient customs and long-existing practice. Previous to the passing of the Act of 1855, under which the Metropolitan Board of Works were created, the Metropolis had been mainly under the government of vestries, with the exception of the comparatively small area which, as now, was under the jurisdiction of the Corporation of the City of London, and, as might be expected, there were hardly two parishes which were governed alike. The object of this Act was to produce greater uniformity of local government, and no doubt a great deal had been achieved, but the evil had only been partially cured. Before the appointment of the Metropolitan Board, the subject had been for many years under the consideration of the ablest and most practical men. Parliamentary Committees and Royal Commissions had sat and reported upon it. Bills were introduced by the Governments of the day, and by private members of the Legislature, which were afterwards withdrawn, and the question seemed to be beset with difficulties, one of which, and he thought not the least, was the attempt to amalgamate the City of London with the surrounding boroughs and parishes. It was, therefore, wise in the Metropolitan Act of 1855 to exclude almost entirely from its operation the City of London. For, while the rights and privileges of that ancient Corporation had happily been respected by Parliament, they had adapted their practice to the wants of the present time, and had set an example of local government which was worthy of being followed. The area and population included within the City boundary was comparatively small, and was numbered by thousands, while outside they came to millions. Excluding, then, as he proposed to do in this discussion, the City of London, what was found existing under the Metropolitan Act? There was a divided jurisdiction in many important matters affecting public interests and public convenience. If they looked outside the City boundaries, there was a population approaching four millions, with an area extending into four counties, and enclosing nine parliamentary boroughs. Under the Act of 1855, this immense district, covered with houses, was placed under the joint government of 38 select vestries or district boards and the Metropolitan Board of Works. The smaller parishes were grouped together and formed district boards, the larger ones being divided into wards, having members according to their sizes. These vestries or district boards had under their management branch drainage, buildings, to some extent streets, water supply, lighting, and sanitary arrangements. The Metropolitan Board had entrusted to them the main drainage and large works, which were carried on by committees. Now he was at a loss to see how it could be for the advantage of the ratepayers or the public that there should be this divided jurisdiction, and these numerous centres of management. He would mention an instance—that of drainage. Could it be a good, or convenient, or economical arrangement that the main drainage should be under the Metropolitan Board, and the smaller drainage under parochial or district boards? Or to take the water and lighting, was it desirable to leave important matters like these, which required unity of action, in the hands of different boards, with perhaps more or less different interests. It was argued, "You will distrust the parochial system if you take away the jurisdiction of vestries;" but was not that done already? They had districts boards formed by the union of parishes instead of vestries, and it was but a small step further to unite these in one central board, to be elected by the ratepayers, who would thus be directly represented, and would exercise more the rights which they were intended to have, than was done under the present system. He came now to the practical results of this divided authority, as existing in the Metropolitan Board of Works and the 38 vestries or district boards; and here he wished distinctly to state that in the remarks which he might offer he desired in no way to attribute maladministration either to the Metropolitan Board or to the different vestries and local boards. He regarded the defects in practice, to which he asked their lordships notice, as the natural and, in many instances, unavoidable consequences of the existing divided authority and jurisdiction. The Metropolitan Board of Works had no control over many of those matters which materially affected public interests and public convenience. Streets were continually disturbed and broken up in different districts, for gas or drainage pipes or other reasons, at inconvenient seasons of the year; new pavement was sometimes laid down in one street and not in another which equally required it; the paving of one street was often of a totally different kind from that in the other adjoining, so that horses suddenly passed from a macadamized street to a slippery wood or asphalte pavement; large masses of broken granite were laid down in some streets at a time when the carriage traffic most required an even road. Steam-rollers were worked at all hours of the day. Streets in the summer were frequently imperfectly watered; and he had heard of an instance where one parish insisted upon watering their side of the street in the morning, while the other watered it in the evening, thereby having dust all the day. These, he believed, were the words of the Act giving power to the vestries to water the streets—"As often as they think fit." This, of course, admitted of a very wide interpretation. So also as regarded crossing-sweepers, to be distinguished by their dress as public servants, the Act allowed them to be appointed, but did not make it compulsory, consequently it was never done. And with reference to clearing the streets of dust or snow, the Act required it to be done at "such hours as fixed by the vestry." It was too well known how imperfectly this was carried out, and in cleaning the streets it was frequently done by aged and infirm persons instead of by improved machinery. And he could not omit to notice the subject of the gas and water supply of the Metropolis. These were, as their lordships knew, in the hands of companies, and, consequently, vestries and district boards were dependent upon those companies, both with regard to the quantity and quality of that supply. The gas of London, as was well known, was inferior to what was used in many other large towns; and there were instances of successful management of gas supply by corporations—as in Manchester, where the gas was made a source of income to the town. In like manner, the quality of a considerable portion of the water as now supplied was not what it ought to be, and what it might be in such a city as London. Then, what an unfavourable contrast did London and other large towns of England afford when compared with towns on the Continent with regard to markets? Where were our meat markets, our fish markets, our general markets? The few which existed were not accessible to a large portion of the population, and the poor as well as the rich had often no choice but dealing with tradesmen at a disadvantage. These were some of the inconveniences, and others might be enumerated, which arose from the divided jurisdiction of so many vestries and district boards; and he could not but think that what he had ventured to suggest would, in a great measure, afford a remedy—*i.e.*, if the management of the Metropolis were placed under the control of a Central Board, such as, or similar to, the existing Metropolitan Board, and to be elected in a direct manner by the ratepayers. He believed it would be more economical, that the work would be better done, and that it would be greatly to the advantage of the public. He had to thank their lordships for listening to what he felt was but an imperfect statement of a large question, and which he trusted might be supplemented by other remarks, in the hope that Her Majesty's Government might be induced to give their consideration and attention to this important subject. As he proposed to move for a return of the sums expended by vestries and district boards of the Metropolis during the past three years, he might mention that there was, he believed, a return of the period between 1856 and 1870, showing a total expenditure of upwards of seven millions.

Earl BEAUCHAMP said that on the part of Her Majesty's Government there was no objection to the production of the papers for which his noble friend had moved. No one could contend that there were not imperfections in the present system of managing metropolitan affairs; but he thought that if regard was had to what had been accomplished since the passing of the Metropolis Local Management Act, it must, in candour, be admitted that the vestries had not laboured without success, and that on the whole the management of the Metropolis would compare favourably with that of continental towns. The Metropolis Local Management Act contained the provisions in accordance with which the vestries were elected and transacted their business. In 1870 a number of questions were addressed to the various vestries of the Metropolis; and the answers to those questions showed that, between the date of the passage of the Metropolis Local Management Act, in 1855, and that year, the sanitary condition of the Metropolis had changed very considerably for the better. Rome was not built in a day, but, considering the vastness of the work they had to do, the Metropolitan Board of Works and the vestries might congratulate themselves on having taken most effective and successful steps in embellishing the Metropolis of this great empire. He was far from denying that much remained to be done; and those who had done so much would be far from denying it. The death-rate of the Metropolis had been considerably diminished, but there was no reason why it should not be diminished still more. As to what his noble friend had said with regard to the pulling up of streets for the purpose of laying and repairing gas and water pipes, all that was disagreeable, but the vestries had no jurisdiction to enable them to prevent it. Then his noble friend had complained that there were different descriptions of paving in adjoining streets, but in reply to that it was to be said that as yet no one kind of pavement was acknowledged to be the best, and it must be remembered that the sort of pavement which answered very well in one street might not be suitable to another, in which perhaps there was much more traffic. As to markets, it would be very hard to hold the vestries accountable in that matter, seeing that after the immense expense to which Lady Burdett Coutts had gone to erect a market at Shoreditch, the splendid market established by her ladyship had not commanded the approval of the people of the locality. Mr. Haywood had shown by statistics that to make provision for the immediate removal of the snow after a heavy fall of snow in the Metropolis would involve an expenditure out of all proportion to the object to be achieved. In short, while some of the complaints made by the noble earl were not without foundation, others were such as it was rather unreasonable to urge against the local authorities, seeing what they had already accomplished.

The Duke of SOMERSET could not agree with the commendations bestowed by the noble earl upon the municipal government of the Metropolis. He

thought that if he took his "intelligent foreigner" through the West-end of London that personage would be very much astonished at the way the public thoroughfares were interfered with by vestries and by gas and water companies. In dealing with streets the vestries ought to act under the control of a central authority, such as the Metropolitan Board of Works.

Earl FORTESCUE thought the system a most defective one, under which not only vestries but gas and water companies had power to take up streets. These companies acted independently of the vestries. Two companies might be pulling up different portions of a street at the same time, and he had known instances in which no sooner had one company taken up a street and put it down again, than another company entered and performed the same operation over again. He was glad to find that the noble earl who had spoken on behalf of the Government did not speak of the management of the Metropolis as being absolute perfection, but he regretted that the admissions which he had were so very qualified. He could not agree with Earl Beauchamp that things had been done so well. On the contrary, he held that at the present moment the state of the Metropolis was far from creditable to the greatest capital in the world. He was of opinion that as the duties of the vestries were administrative, the members of those bodies were too numerous. He must solemnly enter his protest against regarding the present state of administration in the Metropolis as being either satisfactory, efficient, or economical.

The motion was then agreed to.

TUESDAY, MARCH 13.

The Blackburn Borough Gas, Water, and Extension Bill was referred to a select committee, consisting of Lord Strafford (chairman), Lord Auckland, Lord Hylton, Lord Hammond, and Lord Harlech; to meet on Monday, March 19.

FRIDAY, MARCH 16.

The Sittingbourne Gas Bill, brought from the Commons, was read the first time and referred to the Examiners.

HOUSE OF COMMONS.

MONDAY, MARCH 12, 1877.

The Epsom and Ewell Gas Bill was read a second time and committed.

The Sittingbourne Gas Bill, as amended, was considered.

A petition for additional provision in the Leeds Improvement Bill was referred to the Examiners.

The *locus standi* of the Corporation of Doncaster, as petitioners against the Rotherham Corporation Bill, was disallowed.

The select committee on the Longton Corporation and Rotherham Corporation Bills was further altered by the replacement of Mr. Monk as chairman, in place of Sir Dudley Majoribanks.

Mr. Alexander Brown's motion in reference to the Water Supply of Villages and Rural Districts was deferred from Friday, March 16, till Friday, April 6.

TUESDAY, MARCH 13.

The Crystal Palace District Gas and the Bristol United Gas Bills were read a second time and committed.

On the motion of Sir Charles Forster, it was ordered that the minutes of the evidence taken before the committee on the Ramsgate Local Board Bill, in session 1876, be referred to the committee on the Ramsgate Local Board, Ramsgate Water, and Thanet Gas Bills.

The Examiners reported that the further Standing Order applicable to The Gaslight and Coke Company's Bill has been complied with.

A petition against the Thanet Gas Bill, and in favour of the Ramsgate Local Board Bill, was presented from Ratepayers and gas consumers of Margate.

The petitions were withdrawn of the Corporation of Dublin against the Alliance and Dublin Consumers Gas (Bray Supply) Bill; of the London, Chatham, and Dover Railway Company against the Kent Water Bill; and of Property owners and ratepayers of Warrington against the Warrington Corporation Gas Bill.

The constitution of the committee on the Longton Corporation and Rotherham Corporation Bills, was again changed, by the appointment of Mr. Hibbert as chairman, in place of Mr. Monk.

WEDNESDAY, MARCH 14.

The petition of the Metropolitan Board of Works against the Woolwich, Plumstead, and Charlton Consumers Gas Bill was withdrawn.

THURSDAY, MARCH 15.

The Sittingbourne Gas Bill was read the third time, and passed.

The Examiners reported that the further Standing Order applicable to the North Cheshire Water Bill has been complied with.

FRIDAY, MARCH 16.

The Examiners reported that the further Standing Order applicable to the Heywood Water Bill has been complied with.

The following Bills were reported:—Dundee Gas; Edinburgh and District Water; Falmouth Water; London Corporation; Longton Corporation; West Surrey Water.

The petitions were withdrawn of the South-Eastern Railway Company against the Kent Water Bill; and of the London and North-Western Railway Company against the Warrington Corporation Gas Bill.

CHELMSFORD GAS COMPANY.—The annual meeting of shareholders was held on the 24th ult., when a dividend of 10 per cent. was declared upon the whole of the paid-up capital of the company. Much satisfaction was expressed at the recent addition to the works, carried out by the engineer, Mr. Mead, A.I.C.E., and also at the general good condition of the whole concern.

EVESHAM GAS SUPPLY.—At the meeting of the Evesham Town Council on the 10th inst., the town-clerk read a letter from the Local Government Board, stating that they were willing to issue a Provisional Order for extending the borrowing powers of the Town Council, in order to enable them to acquire and maintain the gas-works for the town, on the understanding that the council will pay off their present debt of £4000 within a period of 50 years, in accordance with the principle now generally adopted for the repayment of such debts. It was resolved that, in the matter of the transfer of the gas-works, it was desirable to appoint a committee of members of the council, in lieu of the committee of the whole of the council, and that they be authorized and instructed to make the necessary arrangements for the transfer of the gas-works to the council under the contract, and to employ such professional and other assistance as they may deem necessary, and to report the result for the approval of the council. It was resolved that the sum of £15,000 be fixed as the sum to be authorized to be borrowed under the extended powers, and that the council consent to the order being made upon the terms contained in the above letter.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

FRIDAY, MARCH 16.

(*Before Vice-Chancellor* MALINS.)

In re THE NATIVE GUANO COMPANY.

This was a shareholder's petition to compulsorily wind up the company. On the matter coming before his lordship this morning,

Mr. HIGGINS, Q.C. (with him Mr. EVERITT), for the petitioner, Mr. Anthony Blackburn, asked leave to withdraw the petition on his agreeing to pay the costs of the company up to the day of withdrawal.

Mr. PEARSON, Q.C. (with him Mr. CROSSLEY), appearing for the company, said he thought he should ill perform his duty if he did not draw his lordship's attention to the circumstances under which the petition, now sought to be withdrawn, had been presented, because serious injury resulted to companies from such petitions. No doubt it was right in many cases that a company should be wound up, but to present a petition which was so utterly hopeless, so utterly improper, as this, as was proved by the fact that before it came on to be heard, the petitioner's solicitor advised its withdrawal, was a monstrous abuse of the rules of the Court. The petitioner was the holder of 20 shares out of 29,000 shares, he had been present at a variety of meetings of the company, and had asked questions of the chairman—in fact, had done all he could to injure the company, probably with a view to affect operations on the Stock Exchange. The company being unanimous against him, as a last effort he filed the present petition, and advertised it with the greatest possible haste.

The VICE-CHANCELLOR: He did more than that; he moved to commit the directors.

Mr. PEARSON said he was coming to that point. The next step the petitioner took was to come before his lordship, and ask to have the directors committed for contempt, because the solicitor of the company, the moment he was served with the petition, knowing all the facts, exerted his utmost diligence, summoned all the directors by telegram, and they ordered a circular to be sent round to the shareholders, informing them that a petition was presented, that it was an improper petition, and that it should be opposed. It was plain the petition must have been dismissed, simply upon the ground that the shareholders, not listening to the advice of Mr. Blackburn, were convinced they had a good and lucrative concern, that they were sure to succeed, that they were succeeding, and were determined to carry out the business of the company. Under those circumstances, if Mr. Blackburn had any case at all, instead of coming to the Court, he should have gone to a meeting of shareholders, explained his views, and asked them to agree with him in refusing to spend any more money. But instead of doing that, and knowing he had no case in Court, he, with a view perhaps to effect some change in the price of shares on the Stock Exchange, presented his petition.

The VICE-CHANCELLOR inquired whether it had had any effect upon the price of the shares.

Mr. PEARSON replied that it had done a deal of harm. For instance, the petitioner's solicitor had been down to Aylesbury, where the company had a contract, and told the town-clerk that the company were going to be wound up.

The VICE-CHANCELLOR said it was a most unjustifiable speculation to present a petition to injure a company when the person presenting the petition knew that no ground was alleged in the petition on which a winding-up order could be made.

Mr. PEARSON said he had to ask, although he was afraid it was not in his lordship's power, to give the company their costs as between solicitor and client.

Mr. HIGGINS said he had purposely abstained from interrupting his friend, but after the statements which had been made he felt it his duty to make a few observations.

Mr. PEARSON said the company were bound to meet what was stated in the petition, and, among other things, they were charged with packing the meetings of shareholders. They had been put to considerable expense in preparing affidavits answering such charges, though of course, after the receipt of the notice that the petition would be withdrawn, the affidavits had not been filed, and he should ask for the costs of preparing such affidavits.

The VICE-CHANCELLOR: When did you receive notice that the petition was to be withdrawn?

Mr. PEARSON: On March 12.

The VICE-CHANCELLOR said the company would have the costs up to that date, and also the costs of appearing on the petition.

Mr. PEARSON said that as they had been threatened with a speech from Mr. Higgins, he begged to say that he was not entitled to be heard. The Master of the Rolls had decided that where a petition was withdrawn the Court would not look at it, nor allow it to be opened. He had not dealt with the petition, but simply the question of costs, and had, therefore, a right to be heard.

Mr. RIGBY (with him Mr. GLASSE, Q.C.) said he appeared for a large majority of the shareholders, and must ask for his costs. He did not receive notice that the petition would be withdrawn until the 14th of March.

The VICE-CHANCELLOR said they must have their costs up to the time of receiving notice, including the costs of the present appearance.

Mr. HIGGINS: On behalf of the petitioner——

Mr. PEARSON said he objected to Mr. Higgins being heard.

The VICE-CHANCELLOR said he did not think he could hear Mr. Higgins.

Mr. HIGGINS said that Mr. Pearson had been heard on the question of costs, and also as *amicus curiæ;* and he had just as much right to be heard as his friend. Mr. Pearson had made a violent attack upon the petitioner, under the impression that his counsel would not be allowed to be heard in defence.

The VICE-CHANCELLOR said that Mr. Pearson was quite entitled to address the Court upon the question of costs, but upon the merits of the case he was not strictly entitled to be heard.

Mr. HIGGINS said the attack had been extremely unfair. The petitioner had proved, on oath, that he had been a victim of the company.

Mr. PEARSON again objected to Mr. Higgins being heard.

The VICE-CHANCELLOR said the better way would be to let Mr. Higgins make his statement.

Mr. PEARSON said that if the company had put in their evidence it would have displaced the statement about the petitioner being a victim of the company.

Mr. HIGGINS said as the petitioner had been held up to public indignation, under the impression that his counsel could not be heard, he thought he was entitled to say that a gentleman who paid £29 for £5 shares, in the public market, had great reason to be dissatisfied with the company.

The VICE-CHANCELLOR: If he gave £29 for £5 shares, he must have been a very sanguine man.

Mr. HIGGINS, continuing, said the company was an abortion, and kept up only for Stock Exchange purposes. After the petitioner bought his shares, they receded to 40s. per share, and had still further decreased. At the

time he presented the petition, he was fully under the impression that he would be able to maintain it, and were it not for the enormous weight which the Courts gave to the majority of votes, he would have succeeded. One-half of the shares were held by members of the Stock Exchange, and therefore the petitioner, having such a majority against him, thought it right not to proceed with the petition. The petitioner was a *bonâ fide* shareholder; he considered the company was entirely gone, and was a mere creature of the Stock Exchange, kept up for Stock Exchange purposes. But finding that other branches of the Court had lately held that a winding-up order could not be made when the majority were in favour of continuing, he withdrew his petition. He did hope that his lordship would not give costs to the shareholders appearing, because the company represented the shareholders.

The VICE-CHANCELLOR said he did not see the reason for shareholders appearing to oppose, as the company represented them.

Mr. PEARSON maintained that the shareholders had a right to their costs.

Mr. HIGGINS objected to Mr. Pearson—who appeared for the company—arguing the case of the shareholders, when they were otherwise represented.

Mr. RIGBY understood that his lordship had already given him his costs.

The VICE-CHANCELLOR was not sure that he should have given them. He should be glad to have some authority for giving the shareholders costs when the company represented them.

Mr. RIGBY quoted the case of the *Marlborough Hotel Company*, decided by Vice-Chancellor Kindersley. Shareholders in their individual capacity were invited by advertisement to appear and be heard.

The VICE-CHANCELLOR inquired whether, after the petition was presented, the directors held a meeting at which they came to the conclusion to oppose.

Mr. HIGGINS: Yes; and they sent out a circular stating that the company would oppose.

The VICE-CHANCELLOR: Then I do not see why the shareholders appeared.

Mr. RIGBY said it was the common practice, where the company and shareholders opposed separately, and no order was made, for the shareholders to receive one set of costs. That point had been decided over and over again.

The VICE-CHANCELLOR said the petition was presented for the purpose of having the company, a going concern, wound up. The company had not been very successful, but the great majority of shareholders were of opinion that it would be successful hereafter. The rules of the Court required a petitioner to show that the company had either not commenced business within a year from incorporation, or had suspended business for a year, that the members were reduced in number to less than seven, or that the company could not pay their debts. Those were the only grounds on which a winding-up order could be made. If a company were losing money, and there was every prospect of their continuing to do so, it was not a reason for winding them up, if the majority were in favour of going on. There not being any ground stated in the petition on which a winding-up order could be made, he was bound to say that the presentation of the petition was a very unwise, and, he was inclined to think, an unjustifiable act, it being calculated to do the company great injury. Without at all saying that the petitioner was actuated by improper motives, he must say that the petition ought not to have been presented. But it having been presented, the petitioner had exercised a sound discretion and withdrawn it, as he was entitled to do upon paying the costs. The company would have their costs properly incurred up to the time of notice of withdrawal, including the costs of appearance; and, as it had been decided by other learned judges that shareholders opposing were entitled to their costs, he was bound by those decisions, and should therefore give them the costs up to the time of receiving notice. Had the matter been *res integra*, he should probably not have given them any costs.

SATURDAY, MARCH 17.

In re THE EUPION GAS COMPANY.

Mr. HIGGINS, Q.C. (with whom was Mr. MILLAR), moved on behalf of twelve, out of seventeen, alleged contributories of the company, that so much of the order made by his lordship in chambers on the 3rd of August as affected the applicants, for the payment of the amount alleged to be due from them for calls, be rescinded or discharged, and that all further proceedings against the applicants be stayed.

The VICE-CHANCELLOR: What do you say regarding them?

Mr. HIGGINS: I say they are not contributories, and ought not to pay calls. The facts, shortly stated, were these: Mr. Joseph Aspinall was called upon to pay a call of 2s. 6d. per share in respect of 2200 shares—

The VICE-CHANCELLOR asked whether that would be sufficient to pay all the debts.

Mr. HIGGINS replied that the legitimate debts were very small.

The VICE-CHANCELLOR inquired the amount of the debts.

Mr. COOPER (the liquidator) said the debts amounted to £3000, the assets in hand were £150, and there was nothing further to come in except the present call.

Mr. HIGGINS said the questions raised were simply questions of law. He would first of all take the case of Henry Kelsall Aspinall, because the decision in his case would cover four or five other cases. He was an original allottee. The application for 1000 shares was on the 20th of March, 1874, and on that day Joseph Aspinall paid into the bankers of the company, the National Provincial Bank, the sum of £500 for Henry. On the 30th of March the directors allotted the 1000 shares, and the allotment was duly signified to Henry by the usual allotment letter. On the same day Henry signed a blank transfer of the shares, and forwarded the same to Joseph. On the 7th of April the balance of £500 remaining due upon the shares was paid by Jospeh into the bank. On the 18th of December, 1874, an order to compulsorily wind up the company was made by his lordship. The shares being £1 shares, they were consequently paid up in full by the payments made.

Mr. GLASSE, Q.C. (for the liquidator), said that would be so, and the point would be very simple, if the money paid belonged to Henry.

Mr. HIGGINS supposed the defence would be that Joseph had made an arrangement by which the moneys paid to the credit of the company were to be returned.

The VICE-CHANCELLOR asked whether the moneys were returned.

Mr. HIGGINS replied in the negative. Henry had filed an affidavit, in which he stated that he applied for shares at the request of his brother, that it was understood he was not to have any beneficial interest in them, and that he signed and returned the application at his brother's request.

The VICE-CHANCELLOR said he was, in fact, the brother's cat's-paw.

Mr. HIGGINS said that appeared to be so. He also stated in his affidavit that he only consented to take the shares on the condition that the £1000 paid into the bank was accepted as payment, and that he was in no way a party or privy to any arrangement by which the moneys paid into the bank were withdrawn. Therefore he submitted, upon that evidence, Henry could not be called upon to make any contribution to the company, he being a holder of fully paid-up shares.

The VICE-CHANCELLOR said he understood the real point to be determined was, whether or not the shares had been paid up.

Mr. HIGGINS said that was not the question. The way he put it was simply this: either Henry was a shareholder, or he was not; if he was, it was only by virtue of the application and allotment, and the application was upon the footing of the £1000 being accepted in payment. It came precisely within the decision of Carling's case decided by the Lords Justices. In that case there was a contract to accept shares upon certain terms, and a direct allotment of five shares to a director. But in the present case the allotment was to a perfect stranger of the company. Henry was not a director, his conduct was not impeached; he applied for shares upon the conditions before stated, and upon the decision of the Lords Justices he (Mr. Higgins) submitted that he could not be called upon to pay any call in respect of the shares.

Mr. GLASSE, Q.C. (with him Mr. MONTAGUE COOKSON, Q.C.), appeared for the official liquidator. He submitted that the authorities cited by his learned friend did not apply to the present case, for the simple reason that in those cases there was no application for shares, and, therefore, no contract with the company to take the shares. The short history was as follows:—The directors, for the purpose of the fraud for which they were convicted, borrowed the money one day from the Midland Bank, paid it, in the names of supposed allottees—mere nominees of Joseph Aspinall—at the company's bankers, and the next day the money was withdrawn, so that it never reached the hands of the Eupion Company at all; and his lordship so decided on the 1st of July, 1875, when the case was before him. By the order of the 3rd of August, Henry Aspinall was placed on the list of contributories, as a holder of unpaid shares, and that order was not appealed from.

Mr. HIGGINS denied that the shares were not fully paid up.

The VICE-CHANCELLOR said the only question before him was whether the calls had been paid.

Mr. GLASSE assented. Henry Aspinall, in his affidavit, did not swear that the £1000 was paid by his brother Joseph out of his own moneys.

The VICE-CHANCELLOR said, if the shares were paid for, the company got £1000, and the shareholder ought not to be asked to pay again.

Mr. GLASSE said the only way in which it could be shown strictly, was by going through the evidence, which had satisfied his lordship on a previous occasion, that the money was not paid. Instead of reading the evidence in full, to save time he would put it all in, so that it might be used by the parties if the case should go to another Court.

Mr. HIGGINS said among the evidence to be put in was the affidavit of Charles Knocker, and upon that he wished to ask a few questions. [Mr. Knocker was present, having been brought up on *habeas corpus*.]

Mr. *Charles Knocker*, cross-examined by Mr. HIGGINS.

I made an affidavit in the claim of the Midland Bank against the Eupion Company. The securities referred to in that affidavit were deposited by Joseph Aspinall for a loan to be made by the bank. The securities consisted of shares in an iron company and a gold company. The nominal value of the securities deposited was £32,000. I caused inquiry to be made respecting the genuineness of the securities, and I satisfied myself that they were sufficient to cover any amount the bank would be out of pocket by these transactions. Messrs. Hardwick and Holmes acted as the advisers of the bank in the matter. They were not the ordinary solicitors of the bank; they were the solicitors of Mr. Richardson, the chairman. Sometimes they acted for the bank. They reported that the securities were sufficient. The advances made by the bank were made, to some extent, upon those securities.

Re-examined by Mr. GLASSE: The transactions first commenced on the 19th of March. The security was not first given in the month of May. I received the letter produced, dated the 14th of May, from Mr. Aspinall. I had a security from Mr. Aspinall before that date. The £10,000 mentioned in that letter had nothing to do with the Eupion Company; it was a subsequent loan entirely. Aspinall gave security previous to February. The £2000 mentioned in the letter of February had nothing to do with the money advanced to the Eupion Company. The bank had no further securities than those mentioned in the letters of February and May.

Further cross-examined by Mr. HIGGINS: Having looked at the two letters, I adhere to the statement that the securities represented by the shares were given to the Midland Bank by Mr. Aspinall in respect to the advance made to the Eupion Company.

Mr. HIGGINS was then heard in reply upon the whole case.

The VICE-CHANCELLOR, in giving judgment, said the application made by Mr. Henry Kelsall Aspinall was to rescind the order, so far as it related to him, for the payment of the call of 2s. 6d. per share. He would shortly state the facts. The company was formed by Joseph Aspinall and others for the purpose of working certain gas patents. It had been shown, in the course of the proceedings before the Courts, that the company was, from the beginning to the end, a mere fraudulent, sham scheme, formed simply for the purpose of issuing shares, which, by various fraudulent devices, were to be the means of producing money to the directors, and those associated in the formation of the company. Mr. Joseph Aspinall, Mr. Knocker, and several other directors, having been brought before the Lord Mayor for their fraudulent conduct in the management of the company, were by him committed for trial. They were tried before the Lord Chief Justice and convicted of fraud in the concoction, creation, and management of the affairs of the company. The jury having convicted them, various objections were taken to the form of the indictment, and those objections came before the Court of Queen's Bench, and afterwards the Court of Appeal. The result was they were finally convicted, Mr. Knocker was still undergoing his imprisonment, and Mr. Joseph Aspinall, in consequence of ill-health, had received the Queen's pardon. The matter had been before him in various forms—first, to wind the company up, then to allow the prosecution of the directors to be at the expense of the company, and afterwards with reference to a sum of £35,000, borrowed from the Midland Bank. The Bank parted with that sum through the gross conduct of Knocker, who had, in his examination that morning, aggravated his offence by attempting to impose upon the Court by saying that he took security from Joseph Aspinall for the money lent by the bank. When the matter was before him in July, 1875, he came to the conclusion—as also did the jury afterwards—that the whole thing was a deliberate concocted fraud, that the money was obtained from the Midland Bank for the purpose of fraud, and that the thing was a fiction from the beginning to the end. Now, how did that affect Henry Aspinall, the present applicant? It having been the object of Joseph Aspinall to give shares the appearance of being taken, when in reality they were not, he got his brother, who seemed to have had unlimited confidence in him, to apply for 1000 shares. The applicant, in his affidavit, stated that in March, 1874, he received from his brother a form of application for 1000 shares in the company, and a blank form of transfer for his signature, with a letter asking him to sign and return the documents, that he (Joseph) would pay at once the full amount of capital due upon the shares, and that no personal liability or risk would be incurred by the applicant. He signed and returned the documents, relying, as he said, on such statement, and 1000 shares were allotted to him. Not only was he an allottee, but he had also stood on the list of contributories without objection.

Mr. HIGGINS said he objected when the list was settled.

The VICE-CHANCELLOR: But not in a form which the Court could recognize. If he thought himself wrongly on the list he should have brought the matter before the Court and had the question settled. No such step was taken, and being on the list of contributories, on the list he must remain, and pay the £1000, if it were required, if he had not already paid it. It was not pretended that he had paid it himself; he said his brother Joseph paid it. Had Joseph paid? If he had, the company must have had the money. Had the company had the £1000. The company never had the money—that, like everything else, was a fraud. The evidence satisfied him he did not in fact pay, because directly after he paid the money in he took it out again. It was also quite clear that Joseph was the agent of Henry, and therefore by Joseph's transactions Henry was bound. Henry having made himself the tool of his brother, must suffer the consequence of so doing—viz., be held liable to pay the call of 2s. 6d. per share, and any future call which might be made, as well as the costs. The other cases would stand over until next week.

Mr. GLASSE said he thought they might dispose of Turpin's case, as he did not intend to argue it. He would merely state the case, and leave it in his lordship's hands. Mr. Turpin bought 100 shares upon the Stock Exchange, for which he paid £150. He bought the shares as fully paid up, although, in fact, they were not. He could not be treated as having notice, and therefore he would not press the case against him.

Mr. METHOLD, for Mr. Turpin, cited the case of *Waterhouse v. Jamieson*, in which it was held that a person in the position of the applicant was not liable.

The VICE-CHANCELLOR said every company was at liberty to issue shares with the usual certificate stating the sum paid, and if they issued a certificate stating that A.B. was the holder of "paid-up shares," by that statement they must be bound. As Mr. Turpin bought his shares under the belief that they were paid up, he was not liable; his name must be taken off the list of contributories, and he would have his costs out of the estate.

(*Before the* MASTER OF THE ROLLS.)

In re THE BARKWAY (HERTFORDSHIRE) GAS COMPANY, LIMITED.

This petition, praying for a compulsory order to wind-up the company, was in the paper of his lordship on Saturday last, and when it was called on,

Mr. CHITTY, Q.C., said: The petitioner is a creditor, and there seems to be a case for winding up. I am not even sure that there is any opposition.

The MASTER of the ROLLS: If the company do not appear, you may take an order.

Mr. CHITTY: My lord, there is this upon the affidavit of service. The affidavit is not in the common form. It says, "I did, on Saturday, March 3, 1877, personally serve Baker, the secretary of the company, with a true copy," &c.; and "I say that I served the same upon Baker, at his residence in Barkway, which I am informed and believe is the registered office of the company."

The MASTER of the ROLLS: That will do, if you get a certificate that it is the registered office.

Mr. CHITTY: It is a country service; but we can produce a more formal one if it is thought necessary.

The MASTER of the ROLLS: A certificate that that is the registered office will do.

Mr. CHITTY: Your lordship sees that it is only "I am informed and believe" it is the registered office.

The MASTER of the ROLLS: The certificate will make it regular. You can take the order.

BRADFORD BOROUGH COURT.—WEDNESDAY, MARCH 14.

(*Before the Mayor, Mr.* W. SUTCLIFFE, *Mr.* R. KELL, *and Mr.* S. SCOTT.)

ILLEGAL USE OF GAS.

Edward Purcell, plasterer, Jury Street, was charged, at the instance of the town-clerk, with illegally burning gas, the property of the corporation.

The TOWN-CLERK stated that they might have preferred a charge of theft against the defendant, but they had brought the case forward in the milder form. The Bench might inflict a penalty of £5, and 40s. for each day during which the nuisance was continued, and he wished that they would deal with the defendant in such a way as would tend to suppress this kind of procedure.

John Firth, gas-meter inspector, deposed to having visited the defendant's house on the 1st of March. He then found that the connexion between the meter and the burner had been severed, and the gas was conveyed to the burner by the aid of a flexible tube, direct from the main, consequently it was not registered by the meter. On the 5th of March he repeated the visit, and found the gas in the same condition.

Another inspector gave corroborative evidence.

Defendant said that what he had done had been done in ignorance. He went to live in the house about a month ago, and finding there was no gas, he spoke to the landlady, and acting upon her advice, he attached the pipes, but without the slightest intention to defraud.

The TOWN-CLERK said he was only getting himself out of one difficulty into another. He had no right to connect the gas without giving notice.

Defendant was fined £2, and 12s. costs, or in default to be committed to Wakefield House of Correction for two months.

BIRMINGHAM GAS ARBITRATIONS.—The arbitrators appointed by the Birmingham Corporation and the Local Boards of Smethwick, West Bromwich, Oldbury, and Tipton, met for the first time on Saturday last. Mr. Hawksley, C.E., appeared on behalf of the Birmingham Corporation, and Mr. Bramwell, C.E., for the Local Boards. The clerks of the respective Local Boards and members of the Gas Committee of the Corporation were also present. The proceedings were of a purely formal character, and although the next meeting has not yet been agreed upon, we understand that it will probably be held in the month of July next.—*Birmingham Daily Gazette.*

GAS EXPLOSION AT LIVERPOOL.—On Saturday morning, an explosion of gas occurred in Phythian Street, at the house of Mr. Griffiths. It appears that a workman was engaged in effecting some job in the corner of a small front room used for storeage purposes, and that he detected a strong smell of gas on entering the apartment. He then went in order to turn it off at the meter, and on returning lighted a match to enable him to see under a sink-stone (the room was formerly used as a kitchen). Immediately the match was struck, an explosion took place which shook the whole house, knocked the window almost completely out, sash and glass; shattered the windows of other rooms, and the flame passing through the open door and along the hall, smashed the panes in the back part of the premises. The workman and Mrs. Griffiths were both scorched, the former on his hands, and the latter on the side of the face and head, but the injuries are not of a serious nature. It is thought that the man did not effectually turn off the gas at the meter, or that the accumulation of gas, consequent on a leakage in the chandelier in the room, was greater than he imagined before he struck the match.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

WOOLWICH CONSUMERS GAS COMPANY.—At the meeting of the Metropolitan Board of Works on Friday, the Parliamentary Committee reported that it was not desirable the Board should petition, as it had previously been resolved to do, against the Bill of this company, with the view of obtaining the insertion in it of clauses corresponding to those of the Chartered and South Metropolitan Acts of last session.

Dr. Stevenson's report on the gas supplied by The Gaslight and Coke Company to the vestry of St. Pancras, during the month of February:—Maximum light, estimated by sperm candles, according to the Act—17·3. Minimum light, sperm candles—15·5. Average light, sperm candles—16·5. Traces of ammonia, indicated by turmeric test-paper—Traces only, on all occasions. Traces of sulphuretted hydrogen, indicated by lead test-paper—none. Sulphur, 17 grains per 100 cubic feet.

METROPOLIS WATER SUPPLY.

The Registrar-General publishes the following return of the average daily quantity of water supplied by the London Water Companies during February. According to this, 110,670,113 gallons, or 502,825 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight), were supplied daily; or 209 gallons (95·0 decalitres) rather less than a *ton* by weight, to each house, and 29·4 gallons (13·4 decalitres) to each person, against 29·7 gallons during February, 1876.

COMPANIES.	Number of Houses, &c., supplied in Feb., 1876.	Number of Houses, &c., supplied in Feb., 1877.	Aver. Daily Supply of Water in Gallons* during Feb., 1876.	Aver. Daily Supply of Water in Gallons* during Feb., 1877.
Total supply	523,801	530,656	110,394,788	110,670,113
From Thames	246,016	248,196	57,055,749	55,996,723
„ Lea and other Sources	277,785	282,460	53,339,039	54,673,390
THAMES.				
Chelsea	28,600	28,737	6,980,600	6,955,400
West Middlesex	47,506	48,810	9,226,178	9,313,279
Southwark and Vauxhall	80,346	77,850	18,600,000	17,230,000
Grand Junction	36,036	37,055	10,078,371	10,578,944
Lambeth	53,528	55,744	12,170,600	11,919,100
LEA AND OTHER SOURCES.				
New River	124,051	125,061	24,672,000	24,299,000
East London	109,375	111,967	22,079,500	23,838,000
Kent	44,359	45,432	6,587,539	6,536,390

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for February, 1877, as compared with that for the corresponding month of 1876, shows an increase of 6835 houses, and an increase of 275,325 gallons of water supplied daily.

Dr. Frankland, F.R.S., reports, as the results of his analysis of the waters supplied to the inner, and portions of the outer, circle of the Metropolis during the month of February, that, taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the last nine years as unity, the proportional amount in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was—Tottenham 0·5, Kent 0·8, Colne Valley 1·0, New River 3·1, Chelsea 3·6, East London 3·6, West Middlesex 3·7, Lambeth 3·8, Southwark 3·9, Grand Junction 4·3. The water taken from the Thames and Lea, and delivered by the Chelsea, West Middlesex, Southwark and Vauxhall, Grand Junction, Lambeth, New River, and East London Companies had undergone great improvement since January, and it was all efficiently filtered except that supplied by the Southwark Company, which was slightly turbid and contained moving organisms. The water supplied from artesian wells to the inner circle by the Kent Company, and to the outer circle by the Colne Valley Water Company, and the Tottenham Local Board of Health, was wholesome, bright, and palatable, and of most excellent quality for dietetic purposes. The water delivered by the Kent Company and by the Tottenham Local Board was hard, and therefore unsuitable for washing, but that supplied by the Colne Valley Company was softened by Clark's process before delivery, whereby its hardness was reduced to less than one-fifth of the original amount, and the total solid matters from 38 to 12 parts in 100,000 parts of water. In this way the water was rendered suitable for washing. Seen through a stratum two feet deep, the Kent and Colne Valley waters were clear and colourless. The Tottenham water was also colourless, but not quite clear. The remaining samples presented the following appearances—Chelsea, clear, very pale yellow; West Middlesex, clear, very slightly brown; Southwark, turbid, brownish; Grand Junction, brownish yellow, and not quite clear; Lambeth, clear, very pale brown; New River, clear, very pale brownish yellow; and East London, clear, very pale yellow.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.
Inner Circle.								
Thames—								
Chelsea	30·14	·182	·032	0	·312	·344	1·52	20·0
West Middlesex	29·10	·186	·031	0	·290	·321	1·50	20·3
Southwark and Vauxhall	30·70	·190	·042	0	·297	·339	1·52	21·5
Grand Junction	31·00	·205	·048	0	·281	·329	1·47	21·2
Lambeth	33·06	·192	·033	0	·409	·442	1·78	22·1
Other Sources—								
New River	32·00	·156	·029	0	·328	·357	1·52	22·4
East London	34·40	·188	·026	0	·302	·328	1·70	22·7
Kent	44·74	·041	·007	0	·615	·622	2·45	28·1
Outer Circle.								
Colne Valley	12·10	·046	·011	0	·296	·307	1·32	5·1
Tottenham Board of Health	47·30	·018	·012	·008	·498	·517	3.30	24·2
Corporation of Birmingham*	23·56	·499	·089	·002	·209	·299	1·40	15·5
Corporation of Glasgow+	3·68	·158	·011	·002	0	·013	·70	·7

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
+ Analyzed by Dr. E. J. Mills, F.R.S., of the Andersonian University, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

HARROW DISTRICT GAS COMPANY.

The Ordinary Half-Yearly Meeting of Shareholders was held at the Guildhall Tavern, London, on Wednesday, the 14th inst.—JAMES GLAISHER, Esq., F.R.S., in the chair.

Mr. BAYNES, in the absence of the secretary (Mr. J. L. Chapman) through indisposition, read the notice convening the meeting.

The following report was presented:—

The directors, in submitting the accompanying statement of accounts to the proprietors, are glad to be in a position to report that the business of the company continues to increase.

The illuminating power and quality of the gas have been tested by the gas examiner of the Harrow Local Board of Health and found to be perfectly satisfactory.

Notwithstanding the unusual mildness of the weather, affecting so prejudicially the demand, the gas-rental of the company for the half year shows an increase of £197 11s. 3d., compared with the corresponding period of the year before, and the residual products have also improved.

The balance of profit and loss account shows a total of £1129 10s. 10d. for disposal, which the directors recommend be appropriated to the payment of a dividend at the rate of 5½ per cent. per annum, and to the extinguishment of the preliminary expenses amounting to £237 12s. 5d., leaving a balance of £66 18s. 5d. to be carried forward to the credit of the next account.

One of the directors, Mr. Alfred Henry Baynes, F.R.A.S., and one auditor, Mr. James Randall, retire by rotation, who, being eligible, offer themselves for re-election.

Dr. *Revenue Account, for the Half Year ended Dec. 31, 1876.* *Cr.*

Manufacture of gas—				Sale of gas—		
Coals, including all expenses	£1,253	13	9	Michaelmas quarter—		
Purifying materials, water, oil, &c.	33	9	6	Private rental—		
Salary of engineer	100	0	0	2,114,100 cubic feet at 6s.	£634	4 9
Wages	170	7	0	191,700 cubic feet at 6s. 3d.	59	18 5
Works, machines, and apparatus—maintenance of, repairs, and labour	180	2	6	Public rental and under contracts	94	4 6
Distribution of gas—				Christmas quarter—		
Mains and service-pipes, repairs, maintenance, renewal, and labour	31	1	3	Private rental—		
Meters, renewing, repairing, and refixing	20	12	0	5,657,800 cubic feet at 6s.	1,697	6 7
Public lamps—				541,300 cubic feet at 6s. 3d.	169	3 6
Lighting	20	17	0	Public rental and under contracts	171	3 6
Rents, rates, and taxes—				Meter-rental, half year	69	12 0
Rents	19	10	0	Residual products—		
Rates and taxes	125	11	3	Coke, less labour and cartage	409	0 0
Management—				Tar	81	19 11
Directors and auditors allowances	110	10	0			
Salary of secretary	25	0	0			
Collector's commission	25	0	0			
Stationery and printing	20	3	5			
General establishment charges	57	6	10			
Sundries—						
Bad debts and allowances	17	4	10			
Total expenditure	£2,210	9	6			
Balance carried to profit and loss account	1,176	3	9			
	£3,386	13	2		£3,386	13 2

The CHAIRMAN, in moving the adoption of the report, said it was always a gratification to the directors to meet the shareholders, and especially when they had to render so satisfactory an account of their proceedings as they were able to do on the present occasion. The first paragraph of the report spoke of continued prosperity, and he thought that, if the shareholders would compare the present with any past report, they would see that the company had made a perhaps not very rapid, but certainly a steady progress, and that each half year they had taken a step in the right direction. With reference to the illuminating power and quality of their gas, which was mentioned in the second paragraph, he was happy to corroborate the statement that, upon examination, it had always been found perfectly satisfactory, and he might add that on no occasion had it been below the parliamentary standard. Still, at Harrow, as elsewhere, they were not entirely free from complaints, owing to the defective state of consumers fittings. His own experience in burning gas made him always prompt to see that the fittings were in proper order. Some of his early lessons in the use of gas were taken at the Royal Observatory, Greenwich. The gas supplied there was manufactured by the Phœnix Company, and in his department underground, there were always, night and day, ten or twelve lights in action, photometrically registering the most delicate operations. If one of those lights was bad, and all the others burnt well, it would have been of no use for him to go to the company and complain that the quality of their gas was at fault in the one instance; it was evident that something was wrong with the burner. He, therefore, always had a stock of nipples on hand, and thus effected a ready remedy. Probably, if he had only had one burner in use instead of a dozen, he would, in his ignorance of the cause of defect, have made hundreds of complaints to the company. He remembered at Blackheath, on one occasion, a document was brought to him by a solicitor, signed by a considerable number of persons, many of them in good positions, who ought to have known better, which document was in the nature of a remonstrance to the Phœnix Company about the badness of the gas they supplied. He (Mr. Glaisher) at once said he could not think of signing the paper, as the gas in his house, supplied by the same company, was extremely good, and, as he tested it himself, he knew that it was above the parliamentary standard of illuminating power. His friend suggested that, perhaps he improved his gas by using some hydrocarbons to increase its illuminating power; but he assured him he did nothing of the sort, he only carefully looked to the state of his burners, under the advice of his friend, Mr. Ohren. To inform himself of the nature of his friend's complaint, he visited his house, and found that it arose from the way in which the gas was consumed, and, by simply using a needle to clear the burners, he effected at once such a change in the lights as to quite surprise and convince his friend. The result was that the petition was torn to pieces, and the Phœnix Company never knew of the existence of the document. Thus was it at Harrow. Complaints were occasionally made which were always courteously acknowledged, and the consumers recommended to look after their fittings, which, when set right, always satisfied the complainants. In the next paragraph in the report, the directors spoke of the effect of the unusual mildness of the weather on the sale of coke. In this they did not stand alone; every company had suffered from this cause more or less severely. They had battled with the difficulty as well as they could, and the accounts showed the result. Although they had made 200 chaldrons of coke less, they had received £26 more in cash on that item than before. The next paragraph in the report referred to the profit of the last half year, and stated that the directors proposed to pay a dividend at the rate of 5½ per cent. At the same time, the profits enabled them to extinguish the item for preliminary expenses (£237), and they carried forward a balance of £66. The latter was as small a balance as they could venture to leave, because the difficulties which attended them in the early winter had continued to follow them to the present time. Still the directors had confidence that they would be able to continue the same dividend in the second half of the year, and before long they hoped that the promise held out in the original prospectus of the company would be fully realized. Their business was steadily increasing, not only half year by half year, but month by month, and if fortune should smile on the district, and the long projected railway into the town be constructed, so as to give the inhabitants another road into London, there was no question it would lead to a considerable increase in the number of houses and inhabitants, which would be of great advantage to the company.

Mr. JOHN CHAPMAN seconded the motion, and said that he believed everything in connexion with the company was in a sound and encouraging condition.

The motion having been adopted, it was resolved, on the motion of the CHAIRMAN, seconded by Mr. MAGNUS OHREN, that a dividend at the rate of 5½ per cent. per annum, free of income-tax, be now declared and paid.

The CHAIRMAN moved, and Mr. CUTLER seconded, the re-election of Mr. Baynes, the retiring director, which was agreed to. Mr. James Randall was also re-elected an auditor of the company.

On the motion of Mr. CUTLER, seconded by Mr. OHREN, thanks were voted to the chairman and directors, and speeches in acknowledgment of the re-elections and thanks, terminated the proceedings.

UNITED GENERAL GAS COMPANY.

The Half-Yearly General Meeting of Proprietors was held at the Company's Offices, in London, on Tuesday, the 13th inst.—ROBERT HUDSON, Esq., in the chair.

The SECRETARY (Mr. D. W. Ogg) having read the advertisement convening the meeting, the following report of the directors was submitted:—

The directors submit to the proprietors the following report and audited statement of the company's accounts, for the year ending Dec. 31, 1876.

Considering the competition which has now been going on for nearly two years, by the active opposition of the Limerick Corporation, it is satisfactory to observe that the company's rental has not been materially affected.

The sale of residuals has improved, and had the winter season not been of such an unprecedentedly mild character, the coke would have been more in demand, and the amount sold have added still further to the company's revenue.

The directors have made several additions to the manufacturing plant and apparatus, and a contract has been entered into for telescoping the 70-feet gasholder, which work will be commenced in the spring and completed in time for next winter's requirements.

Since the meeting of proprietors in September last, the directors have made application to Parliament for an Act, conferring certain necessary powers upon the company.

The profits of the year, after deducting £224 for depreciation of plant, being at the rate of 1 per cent. per annum on the investment, amounts to £1730 17s. 8d.; balance of undivided profit, £165 6s. 3d.; making a total of £1896 3s. 10d., from which the directors recommend the proprietors to declare a dividend of 3s. per share (free of income-tax), £1350; leaving a balance to be carried to the next account of £546 3s. 10d.

Dr. *Abstract of the Limerick Working Account, for the Year ending Dec. 31, 1876.* *Cr.*

Coals	£3896	18	0	Gas-rental, one year	£6642	15 10
Wages	719	19	1	Residual products	2705	15 3
Salaries	355	19	0			
Rents and taxes	384	14	7			
Charges	546	7	5			
Allowances and bad debts	426	11	3			
Wear and tear	702	3	8			
Gas-meter repairs	186	9	5			
Depreciation of plant	224	1	9			
Balance, working profit	1905	6	11			
	£9348	11	1		£9348	11 1

On the motion of the CHAIRMAN, the report and accounts were adopted, and the dividend recommended by the directors declared.

The usual votes of thanks terminated the proceedings.

OTTOMAN GAS COMPANY, LIMITED.

The Ordinary Meeting of Shareholders was held at the Company's Offices, 85, Cheapside, London, on Thursday, March 15—S. A. BECK, Esq., in the chair.

The SECRETARY (Mr. A. J. King) read the notice convening the meeting, and the following report and statement of accounts were presented:—

The directors herewith present the audited statement of accounts for the year ending Dec. 31, 1876.

The gas-rental for that period amounts to £7324 11s. 3d., and the net profit (after paying interest on debentures) to £2497 14s. 2d., which, added to the balance brought forward, makes the sum of £2932 11s. 1d., which the directors propose to deal with as follows:—

A dividend of 7 per cent. on the preference shares	£498	15	0
A dividend of 3 per cent on the ordinary shares	1500	0	0
To write off from the preliminary expenses account	500	0	0
Leaving a balance to carry forward of	433	16	1
	£2932	11	1

And resolutions will be proposed at the general meeting accordingly.

The directors retiring by rotation are Henry Deffell, Esq., and Dr. Fraser, who being eligible, offer themselves for re-election. The auditors, E. P. Rowsell, Esq., and George Allin, Esq., also offer themselves for re-election.

Dr. *Balance-Sheet, Dec. 31, 1876.* *Cr.*

Capital	£50,000	0	0	Plant	£43,508	0 5
Do., preference shares, viz.—				Concession and preliminary expenses	13,500	0 0
1025 shares, £5 paid	5,125	0	0	Amount owing for public lights	2,270	12 5
1000 shares, £2 paid	2,000	0	0	Sundry debtors	3,280	0 1
Debentures	5,200	0	0	Stocks	5,715	5 2
Sundry creditors	4,884	6	7	Office furniture	60	0 0
Profit and loss account—				Cash	1,807	19 7
Amount brought forward	434	16	11			
Add for 1876	2,497	14	2			
	£70,141	17	8		£70,141	17 8

Dr. *Profit and Loss Account for the Year ending Dec. 31, 1876.* *Cr.*

Cost of coals	£2,465	9	10	Gas rental	£7,324	11 3
Wages and materials	1,003	7	4	Products	799	16 2
Salaries and office expenses, Smyrna	995	17	3	Net profit on chandeliers, fittings, meter-rents, &c.	564	5 8
Bad debts and allowances	91	5	0	Transfer fees	1	12 6
Exchange	479	6	11			
Repairs and renewals	207	8	5			
Debenture interest	321	0	0			
Directors fees	300	0	0			
Rent, salaries, interest, and discount, and office expenses, London	308	6	4			
Income-tax	20	10	4			
Balance (profit)	2,497	14	2			
	£8,690	5	7		£8,690	5 7

The CHAIRMAN, in moving the adoption of the report, said they had, unfortunately, rather less rental last year, but this was partly compensated for in the reduced cost of coals. The other items in the accounts were very similar to those presented at their last meeting. The directors might have divided 3½ per cent., as before, but seeing how bad trade was throughout Turkey, in Smyrna particularly, they had deemed it prudent not to go beyond 3 per cent., and he hoped the shareholders would approve of that course. They had paid £500 off preliminary expenses, as before, and had reduced their debentures about £5000 since 1872, so that, upon the whole, he thought they might congratulate themselves upon the position of the company.

Mr. HORNER seconded the motion, which was put and carried.

The CHAIRMAN then moved that a dividend at the rate of 7 per cent. upon the preference shares, and 3 per cent. upon the ordinary shares, free of income-tax, be declared.

Mr. HORNER seconded the motion, which was put and carried.

The retiring directors were re-elected, and Mr. DEFFELL returned thanks for himself and colleague. The retiring auditors were also re-elected.

A vote of thanks having been passed to the directors,

The CHAIRMAN acknowledged the compliment. The company was a small undertaking, but the directors all took a deep interest in its prosperity, and had worked together assiduously to secure its success. He felt bound to say that they had been most fortunate in having a good manager at Smyrna, and a most able secretary in London, and this had been of the utmost service to them.

Mr. HORNER remarked, as a proof of the excellent condition of the company's plant, that the leakage at Smyrna was only 5½ per cent. He thought few foreign gas companies could say that.

The CHAIRMAN: Or English either.

A vote of thanks to the secretary, acknowledged by Mr. King, closed the proceedings.

BRISTOL UNITED GAS COMPANY.

The Half-Yearly General Meeting was held on Thursday, March 15—F. TERRELL, Esq., in the chair.

The SECRETARY (Mr. H. H. Townsend) read the report of the directors, which was as follows:—

In accordance with the practice now adopted by the company, a printed copy of the accounts for the half year ended the 31st of December last has been sent to each proprietor in the company. The profits for the half year will be found sufficient to meet the usual dividend which has for some years been paid by the company.

At the last half-yearly meeting of proprietors the directors announced an intended reduction in the price of gas, from 3s. 6d. to 3s. 3d. per 1000 feet, from and after Jan. 1, 1877. That reduction has now been carried into effect, and, of course, will be perceptible in the current half year's revenue, when made up to the 30th of June next.

The Bill in Parliament, to which the proprietors gave their assent at the special meeting convened under Lord Wharncliffe's Act, and held on the 28th ult., has been read a second time in the House of Commons, and will no doubt be carried through both Houses without any material obstruction.

Possession has been obtained of the greater portion of the land lately purchased at Stapleton, and the whole purchase will very shortly be completed. Your engineer is engaged in preparing his plans for its occupation by the new works which have become necessary to meet the annually increasing demand for gas.

The directors, desiring to recognize the long and efficient service of the secretary, and the greater responsibilities of his office in connexion with the extension of the works, recommend that from and after the 29th of September last his salary be increased from £600 to £800 per annum.

The directors recommend that a dividend at the rate of 10 per cent. per annum on the capital of the company entitled to dividend be declared, and made payable at the bank of Messrs. Cave, Baillie, and Co., Bristol, on and after Monday, the 26th day of March inst., subject to the deduction of income-tax.

The CHAIRMAN said there was nothing in the accounts calling for any special remark. The directors were quite satisfied with them, and he hoped the proprietors also would be satisfied with them. In the report the price of gas was dwelt upon, the 3d. per 1000 being a reduction to the general consumer. This would make a difference in the revenue of between £4000 and £5000, but they trusted that the increased consumption would make up the deficiency, and that the revenue would reach the usual amount. A gratifying fact was that no one now complained of the quality of the gas. There used to be a great deal of grumbling, especially by the Sanitary Authority, but within the last six months even the grumblers at that board had ceased to grumble. The Bill which was being promoted by the company in Parliament was progressing very satisfactorily, and he did not think they would meet with any opposition of consequence. As the report stated, they had purchased the land at Stapleton for new works, and he hoped that gas would be made in that district within three years from that time. With respect to the increase of salary to the secretary, he thought he might say that Mr. Townsend's qualities as secretary could not be equalled. When he came to the company he had a natural aptitude for the work, which had been increased by 40 years service; and he (the chairman) thought they would allow that 40 years service entitled him to great consideration. Alluding to the growth of the operations of the company during those 40 years, the chairman said that 40 years ago the production of gas (with two companies) was about 60,000 cubic feet per 24 hours; now the production was 3,500,000 cubic feet per 24 hours. Forty years ago the price of gas ranged from 7s. to 12s. per 1000 cubic feet; now it was 3s. 3d. per 1000, and no doubt there would yet be a further reduction in price. He moved the adoption of the report and accounts.

Mr. T. T. TAYLOR seconded the motion, and said he thought the board had done right in purchasing the ground at Stapleton for the development of the works. He considered there was a large increase of business in store for the company, and that at present there was no prospect of their resting and being thankful.

Mr. GILES inquired what steps were being taken to counteract the influence of naphthaline in the manufacture of their gas. He approved of the extension of their works, as a company which enjoyed a monopoly should always keep ahead of the demand.

Mr. FIDDES, the engineer, explained the expedients adopted to counteract the naphthaline, which had so far been successful that retorts which were formerly required to be cleaned out every month had now been in use nearly three years without requiring to undergo that operation.

The motion was then adopted, as was also a resolution declaring a dividend at the rate of 10 per cent. payable on the 26th inst.

The SECRETARY acknowledged the adoption of that part of the report referring to himself and their kind recognition of his services. He had simply endeavoured to do his duty, and did not wish to take credit for anything that did not fairly belong to him. As in the past, so in the future, as long as he had health and strength he would endeavour to deserve their confidence, and his best energies would be exerted in promoting the interests of the company.

The meeting was then made special, and a series of resolutions were passed adopting a special report, and authorizing the directors of the company to issue from time to time new shares or stock of a nominal value not exceeding the sum of £50,000, and to exercise the borrowing powers of the company in respect of the said sum of £50,000, either by the issue of debenture stock or on mortgage, at their discretion. Also, to authorize the directors from time to time to issue debenture stock in substitution for, and to pay off existing loans, and up to the extent of their borrowing powers. It was explained in the report that the additional capital was required to meet the expenditure rendered necessary for the increasing demand for gas.

A vote of thanks to the chairman and directors (proposed by Mr. GILES, and seconded by Mr. G. WILLS) terminated the business of the meeting.

WATTON GAS COMPANY.—The annual meeting was held on the 6th inst.—Mr. T. Barton in the chair. The increasing demand for gas had led to the erection of a new gasholder since the last meeting, at a cost of £260. A dividend as usual, at the rate of 5 per cent., was declared.

ROCKHAMPTON (COUNTY LIVINGSTONE, QUEENSLAND) GAS AND COKE COMPANY, LIMITED.

The Half-Yearly Meeting of Shareholders was held in the Municipal Council Chambers, Rockhampton, on Thursday, Dec. 21, 1876—Mr. HENRY JONES, chairman of the board of directors, occupying the chair.

The SECRETARY (Mr. H. Mills) having read the advertisement convening the meeting, the reports of the directors and engineer were read as follows:—

Directors Report.

Your directors have the pleasure to report that the business of the company has steadily progressed during the present half year, and the result, as shown by the balance-sheet, enables them to recommend payment of a dividend at the rate of 10 per cent. per annum on all shares paid up.

For ordinary wear and tear and renewals, the sum of £140 has been written off, and is shown in the balance as "depreciation on fixed investment."

It is necessary to create a reserve-fund for contingencies and the equalization of future dividends, and the directors therefore propose to appropriate the balance, after payment of dividend, for this purpose.

The system of discounts for prompt payment is found to work favourably, and enables all who avail themselves of it to obtain their gas at a considerable reduction.

After the last general meeting, all preference shares were eagerly sought after, and sold. The company still hold 103 original forfeited shares, for which there are inquiries.

The subject of extensions has been carefully considered, and your directors have ordered from England 100 tons of mains and services, which they hope to receive in March or April next, and a portion of these will be ready for profitable employment during the winter months.

Managing Engineer's Report.

I have the pleasure to lay before you for your information report of the general condition and progress of your works, the quantity of coal carbonized, and the amount of gas sold for the half year ending Nov. 30.

During the half year I have taken down one bench of retorts and replaced them with new ones, doing the whole of the work, including brickwork, with the help of the ordinary hands employed on the works. This ensured good solid work, and the result is a considerable saving in the fuel, and increase in the amount of gas produced per ton of coal carbonized.

The whole of the building, carbonizing, purifying, storeage, and distributing plant, street-mains, and services, have been maintained in good order and condition, the most careful attention being directed to detect any defects, and remedy them at once. The leakage averages from ¼ to 8 per cent.

During the half year a number of extensions have been decided upon, both in the carbonizing power and in the street-mains, the pipes and other materials for which may be expected to arrive shortly, when the works will be proceeded with.

The quantity of coals carbonized for the half year has been 247 tons 10 cwt., and the amount of gas sold, 1,893,260 cubic feet, of a quality equal to 15 candles. The demands for coke and tar show a satisfactory increase.

(Signed) W. SMITH, Managing Engineer.

Dr. Profit and Loss Account for the Half Year ended Nov. 30, 1876. Cr.

Manufacture, distribution of gas, and management	£975	13	3	Balance, May 31	£952	15	7
Interest account	13	1	8	Sales of gas, coke, and tar	1,740	14	9
Discount on gas-rents	35	15	10	Scrip and transfers	1	2	0
Depreciation written off fixed investments	140	0	0	Rent of dwelling-house	22	10	0
Dividend Aug. 1	948	18	9				
Profit balance from last half year	3	16	10				
This half year's profit	599	16	0				
	£2,717	2	4		£2,717	2	4

Liabilities and Assets.

A. J. S. Bank			£102	6	10	Fixed investment—	
Original capital, 2000 shares at £5	£10,000	0	0	Land, buildings, machinery, mains, meters, &c.		£11,638	12 7
Preference capital, 1000 shares at £5	5,000	0	0	Floating investment—			
	£15,000	0	0	Coal, coke, and tar		655	3 9
Less due from shareholders, and preference shares not called up. £2559 6 11				Sundry debtors		403	2 11
103 forfeited shares 480 5 11				Cash in hand		12	7 7
	3,039	12	10				
			11,960	7	2		
Unclaimed dividends			43	0	0		
Profit and loss			603	12	10		
			£12,709	6	10		£12,709 6 10

A proposition was made by Mr. J. BOYCE, and seconded by Mr. J. JOYCE, that the dividend of 10 per cent. be paid on and after the 28th of December.

An amendment was proposed by Mr. W. PATTISON, and seconded by Mr. A. BELL, that the payment be made on the 3rd of January.

A further amendment was proposed by Mr. E. P. LIVERMORE, and seconded by Mr. J. FORREST, that the dividend be paid on and after ten a.m. on the 23rd of December.

The latter amendment was ultimately carried.

A vote of thanks was then passed to the directors for their services during the past half year, and the meeting terminated.

PURCHASE OF THE CLITHEROE GAS AND WATER COMPANIES.

A Meeting of the Clitheroe Town Council, as the Urban Sanitary Authority of the District, was held on Thursday, March 8—the MAYOR (Mr. J. Mitchell) presiding—the first business being to consider agreements entered into on behalf of the Authority with the Clitheroe Water-Works Company and the Clitheroe Gas Company for the purchase of the works of the respective companies, and, if so determined, to approve of and confirm the same, and to order the common seal to be affixed thereto.

The MAYOR said that in this matter he would take up little of the time of the council. The question, however, they had to deliberate upon that morning was of far greater importance than any question that had hitherto come before the corporation. He congratulated not only the two companies, but the council, in having by mutual concession succeeded in coming to a conclusion which, in his opinion, would not only be satisfactory to the sellers, but also to the ratepayers. These companies took the businesses in hand when the ratepayers refused to do anything of the kind. They had nursed and cultivated them, and made them both admirable properties. They were entitled, as they insisted, to the full value of their works, and the corporation had given, he believed, a price that would be satisfactory to all. He proposed, without further comment, that the agreement entered into between the sub-committee and the water-works company be affirmed.

The following is a memorandum of the agreement:—

The said company, in consideration of the annuities and of the sum of £4000 hereinafter agreed to be paid by the said authority, agree to sell, and the said authority to purchase, all the water-works property, lands, rights, powers, privileges, easements, plant, stock, and effects of the said company, whether vested in or held in trust for the said company, with the incidents and appurtenances thereto respectively belonging in as full, ample, and beneficial a manner as the said company now can, or ought to hold, possess, exercise, and enjoy the same, subject to all rents payable from or by the said company, and the covenants and agreements affecting the same, except in respect of loans and debts, such sale to take effect as from March 25, 1877, and on the terms and conditions following:—The said authority to pay to the said company the sum of £4000 by way of bonus in satisfaction of back dividends for the holders of the original shares in

the said company on the completion of the transfer of the said undertaking; and also to legally and effectually secure to the persons who shall be shareholders in the said company, on the said 25th of March, their executors, administrators, and assigns, perpetual annuities of 10 per cent. per annum on the amount of the share-capital of the said company respectively held by them, both old and new shares, such annuities to be secured with all usual powers, in case of being in arrear, on the works, property, and privileges of the said company, and also on the general district rates made by the said authority within their district, and to be payable in equal portions half yearly on every 25th day of March and the 25th day of September in every year, or within 21 days thereafter respectively, the first payment to be made on Sept. 25, 1877, and to be free from all deductions except property-tax. The said company to pay all its loans and debts, and all rents, rates, and taxes, and working expenses up to the said 25th of March, and to retain for its own benefit all water-rents and arrears thereof up to that time, as well as its reserve-fund. The stock of pipes and other loose materials which may be on hand on the said 25th of March, as per book produced, and appearing in the last balance-sheet at £139 0s. 1d., to be handed over to the said authority gratis. All expenses of the transfer to be paid by the said authority. No abstract of title to be required by the said authority; but on the completion of the transfer, all deeds, books, and documents to be delivered to the said authority. Until the completion of the said transfer, all water-rents accruing from the said 25th of March to be paid to a joint account at the Craven Bank, Clitheroe, of the said company and the said authority, and all payments made therefrom to be by cheque signed by the chairman of the said company and the water committee of the said authority; but the works to be managed by the said authority from the said 25th of March. In the event of non-payment of the £4000 on the 25th of March, the same shall bear interest at the rate of 4½ per cent. until payment.

Councillor GRIME seconded the motion, and he did so because he felt that the time had come when these properties ought to become the property of the corporation. The feeling outside was the same, and the people would be glad when the matter was settled.

The motion was put to the meeting, and carried unanimously.

The MAYOR said that he would at once proceed to make the same resolution with reference to the gas-works, and, without any remarks, moved that the following agreement between the Clitheroe Gas Company and the Corporation be confirmed:—

The said company, in consideration of the annuities, and of the sum of £3325, hereinafter agreed to be paid by the said authority, agree to sell, and the said authority to purchase, all the gas-works, property, lands, rights, powers, privileges, easements, plant, and effects of the said company, whether vested in, or held in trust for the said company, with the incidents and appurtenances thereto belonging, in as full, ample, and beneficial a manner as the said company now can, or might hold, possess, exercise, and enjoy the same, subject to all rents payable from or by the said company, and the covenants and agreements affecting the same, except in respect of loans and debts, such sale to take effect as from July 1, 1877, and on the terms and conditions following, viz.:—The said authority to pay to the said company for the ordinary shareholders the sum of £2887 10s., by way of bonus for the uncalled amount of such shares, and £437 10s. in satisfaction of back dividends, on the completion of the transfer of the undertaking, and also to legally and effectually secure to the several persons who shall be shareholders in the said company, on the said 1st of July, their executors, administrators, and assigns, perpetual annuities as follows, that is to say:—To the holders of class A and B shares, 5 per cent. per annum; to the holders of class C and D shares, 10 per cent. per annum; to the holders of the ordinary shares, on £6 the amount paid up thereon, £7 10s. per cent. per annum. Such annuities to be secured with all usual powers in case of non-payment, on the works, property, and privileges of the said company; and also on the general district-rates made by the said authority within their district, and to be payable in equal portions on the 1st of January and the 1st of July in every year, or within 21 days thereafter respectively, free from all deductions, except income or property tax. The said company to pay all its loans and debts, and all rates, taxes, and working expenses, and outgoings of every description, up to the said 1st day of July next, and to retain for its own benefit all accounts, gas-rents, rents, and arrears thereof, up to that time, as well as its reserve-fund. The stock of coal, coke, lime, and gas, which may be on hand on the said 1st of July, to be taken at its original cost. All expenses of the transfer to be paid by the said authority. No abstract of title to be required by the said authority, but, on the completion of the transfer, all deeds, books, and documents to be delivered to the said authority. Until the completion of the said transfer, all gas-rents and other moneys accruing from the said 1st of July next to be paid to a joint account at the Craven Bank, Clitheroe, of the said authority and the said company, and all payments made therefrom to be by cheques, signed by the chairman of the said company and the gas committee of the said authority; but the works to be managed by the said authority from the said 1st of July. If the said sum of £3325 is not paid on the said 1st of July, it is to bear interest from that date until payment, at the rate of 4½ per cent.

Councillor GRIME seconded the motion, which was also carried unanimously.

It was then resolved to apply to the Local Government Board for powers to borrow sufficient money to complete the purchases, on the mortgage of the corporation property.

GAS EXPLOSION AT BRIGHTON.

On Wednesday morning last, an explosion of gas of a very alarming character occurred in the King's Road, Brighton, at the corner of Market Street. The result was an immense damage to property; but, fortunately, the accident was unattended with loss of life or serious personal injury. The primary cause of the mischief appears to have been a broken water-main belonging to the corporation, underlying the 6-inch gas-main of the Brighton Company, which runs along the road at some 12 inches below the surface of the ground. The leakage from the water-pipe had softened the earth in all directions, and made it incapable of sustaining the weight of a heavy steam-roller, which had been at work on the spot that morning. The passage of the roller snapped the company's main, and the gas escaping in large quantities into the lower part of the adjoining premises, where it became ignited, a tremendous explosion took place. Several houses were more or less damaged, some of them almost completely wrecked, while the furniture and the valuable stocks of jewellery, silk, and other goods contained in them were scattered in all directions. Within an hour after the explosion the gas-mains at a lower level were logged, more than 200 gallons of water having flowed in through the crack from the water-main. The gas-main itself was found to be as perfect a casting as when delivered from the foundry, and the fracture itself was as bright as it could be.

THE THEORY OF THE BUNSEN LAMP.

The *Chemical News* publishes the following report of the proceedings of the Chemical Society on the 1st inst., when Professor THORPE read a paper "On the Theory of the Bunsen Lamp":—

Professor THORPE, after some preliminary remarks as to the great value of this lamp, both to the scientific chemist and in the arts, pointed out the origin of it at the time when Bunsen introduced coal gas into his laboratory. He considered the contrivances which had been used in this country as unworthy of the fuel they had to burn, and, bringing his own inventive powers to bear on the subject, the Bunsen lamp was the result; the original apparatus differing but little from that now generally in use. After a short description of the lamp, the mode by which the air is drawn in at the holes at the bottom, and caused to mix with the gas, was considered. This is due to the well-known fact that when a gas issues from an orifice under pressure, it carries with it more or less of the circumjacent air, partly as the result of the expansion, and partly as the result of its viscosity. This was experimentally illustrated by an ingenious adaptation of List's multiplying manometer, which, when connected with one of the holes at the base of a Bunsen lamp, distinctly showed the rarefaction produced by the gas as it issued from the jet, despite its low pressure. The intermixture of the gas and air in the tube is greatly facilitated by the spreading out of the gas stream after leaving the jet, and the amount of air carried in varies, of course, with the size of the air-holes, being in an ordinary burner from two to two-and-a-half times that of the gas. An average lamp, giving a flame 120 millimètres high, burns about 80 litres of gas per hour, so that as much as 250 litres of mixed gases pass through the tube of the lamp in that period of time. In some modifications of the lamp, such as Wallace's, the proportion of air is very largely increased, but then it is necessary to resort to some such contrivance as a perforated cap to prevent the flame retreating down the tube and burning below; for from Mallard's observations on the maximum rapidity of the propagation of combustion, it is evident that the velocity of the current of mixed gases in the tube of the Bunsen lamp would have to exceed that of the velocity of the propagation of combustion, in order that the flame should not retreat down the tube. Having traced the progress of the mixture of air and gas up the tube, attention was directed to the flame itself, which is hollow, and contains a large internal area of the uninflamed mixture, as it has been found that a mixture of gas with less than three-and-a-half times its volume of air will not burn; it is only, therefore, when it meets with an additional supply of oxygen from the surrounding air that combustion occurs. The composition of the gas in the uninflamed interior cone is not the same in every part, however, as has been shown by Blackmann; the amount of hydrogen, of the hydrocarbons, and of oxygen diminishing, and that of the carbonic oxide, carbonic acid, and especially the aqueous vapour and nitrogen, being largely increased, the latter being derived from the surrounding air. This was still more clearly shown in a table giving the amount of air mixed with 100 volumes of gas, both in the tube and at various distances above it. The cause of the rapid diminution in the proportion of hydrogen, and the corresponding increase in aqueous vapour, is to be sought for in the greater diffusive power of the gas, and the lower ignition point of a mixture of hydrogen with air. If the supply of air be cut off from the air-holes at the bottom of the Bunsen lamp, the flame becomes luminous, so that the non-luminosity of the flame is due to the air, and at first sight it would be imagined that it was due chiefly, if not entirely, to the oxygen in the air, since it is known that an admixture of air with coal gas greatly decreases its luminosity. The nitrogen, however, is concerned in the matter, for if, instead of supplying air at the holes at the bottom of the lamp, we supply nitrogen, or even steam, the flame at once ceases to be luminous, showing that the oxygen of the air is not necessarily the true cause. Knapp has shown that any indifferent gas, as carbon dioxide or hydrochloric acid, will produce the same result. Frankland proved many years ago that a mixture of marsh gas and air, which was almost destitute of illuminating power, might be made to give a luminous flame by heating the gas to redness; and Wibel has recently shown that the ordinary Bunsen flame is luminous when the gas is previously heated. This fact was experimentally illustrated by means of a Bunsen lamp with a platinum tube. When the latter was heated to redness by means of a blowpipe, the flame became luminous, as when the air supply is cut off from the holes at the base. The feeble luminosity of the Bunsen flame would appear to be due to a variety of causes, such as the oxidation of luminiferous material, the action of the nitrogen and other diluting gases, and the withdrawal of heat by the indifferent gases, such as nitrogen, carbon dioxide, and water vapour; for, although the temperature of a flame of coal gas mixed with air is higher than that of one of unmixed coal gas, it requires a still higher temperature in order to become luminous. When the gas is lowered in the Bunsen lamp, and the flame becomes very small, it will be seen that it does not rest immediately upon the end of the tube—a fact due to two causes, namely, the cooling action of the tube, and to the velocity of ignition of the mixed gases being less than the rate at which they issue. When the flame is very small, we all know that the least current of air causes the flame to retreat down the tube and ignite the gas at the jet below. This is due to an admixture of air causing the velocity of ignition of the mixed gases to become greater than the rate at which it passes upwards in the tube. When the flame burns at the bottom, a very much smaller quantity of air passes into the tube, and the gas which issues at the top is entirely deprived of oxygen, and has, moreover, a disagreeable odour, arising in part from the presence of acetylene formed by the imperfect combustion of some of the hydrocarbons present; the amount of carbon monoxide also is very largely increased. The pernicious effect of this partially burned gas is due to the acetylene and carbon monoxide thus formed.

The PRESIDENT (Professor Abel, F.R.S.) in thanking the lecturer, remarked that it would have been difficult to select a subject having a more special interest for working chemists; he had brought before them facts with which many were only generally or very partially acquainted, and made them familiar by his explanations and admirable experimental illustrations. Of those points of interest in the theory of the Bunsen lamp which had been mentioned, perhaps those bearing on the luminosity of flames were of the greatest interest at the present time, when so much attention was being directed to the subject.

Dr. FRANKLAND said that, although he had not paid any special attention to the luminosity of the Bunsen flame, it had been a point of special interest to him to ascertain the cause of the greater or less luminosity of flames under certain conditions. With regard to the effect of dilution on the luminosity of the Bunsen flame, it had been advanced that when gases containing oxygen had been employed, such as carbonic anhydride, they had given up their oxygen; but there could be no doubt that this was not the case when nitrogen was used. From his own experiments it was evident that a comparatively slight elevation of temperature has a great effect on the luminosity of a flame which was just on the point of becoming luminous. He had resumed his researches on the luminosity of flames, and might say that he had repeated the very important experiments of Heumann, whose details of results he had found to be most accurate. He might mention that the exceedingly luminous flame of phosphoretted hydrogen did not give the faintest shadow in bright sunlight, showing that no solid matter was present in it; but as to whether the luminosity of carbonaceous flames was due merely to the great density of the hydrocarbon vapours, or to solid particles of carbon, was a matter which must still be considered as *sub judice*. The two important points to be determined were the presence or absence of polarized light in carbonaceous flames, and as to whether a flame whose luminosity was undoubtedly due to the presence of solid particles would behave in the same way under diminished pressure as hydrocarbon flames, such as that of a candle, &c.

Mr. VERNON HARCOURT wished to ask the lecturer whether the luminosity of the Bunsen flame, when the tube was heated to redness, might not be due, in part, to the formation of tarry matters or of hydrocarbons containing a large proportion of carbon, as it was not possible that the mixture of gas and air could be passed through the red-hot tube without undergoing considerable change.

Dr. WRIGHT suggested that the effect of heating the tube was comparable with that produced by lighting the jet below.

Professor THORPE replied that Heumann had very carefully examined into the matter, and had found that when the experiment was properly performed there was no deposit of tarry or carbonaceous matter in the tube. If a much longer platinum tube to the Bunsen were employed, and only the lower part heated, so that the gases became cooled again before being burnt, the lamp gave a non-luminous flame, showing that the luminosity was chiefly due to the heating. In reply to a question put by Professor Foster, he said that when a cold body was introduced into the luminous flame soot was deposited on it.

SOLVAY'S DISTILLING APPARATUS FOR THE CONCENTRATION OF GAS LIQUOR FROM GAS-WORKS.

By Dr. G. Th. Gerlach, of Kalk.

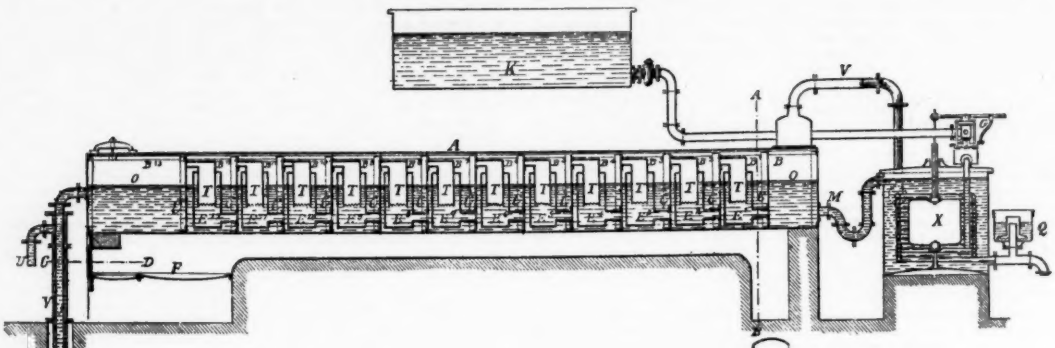


Fig. 1.—Longitudinal Section.

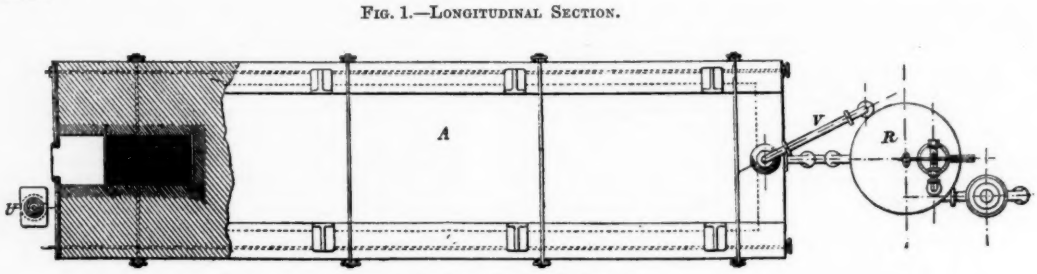


Fig. 2.—Plan on Line C D (fig. 1).

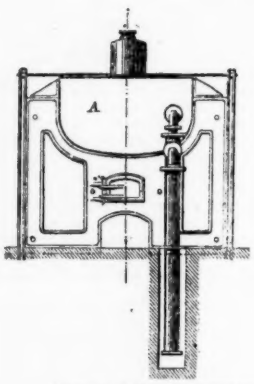


Fig. 3.—End Elevation.

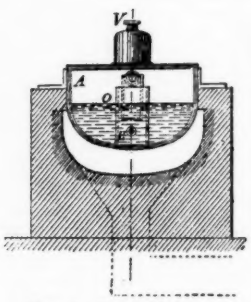


Fig. 4.—Cross Section, Line A B (fig. 1).

I have several of Solvay's new distilling apparatus in use myself, and have also erected two at Rome and one at Utrecht. I cannot sufficiently praise this apparatus, which is equally ingenious and practical, and as it is scarcely known in Germany, I trust that a description based upon a drawing in the "*Revue Universelle*" for 1875, may draw attention to it.

With a view to systematic arrangement and continuous action in distilling apparatus, several boilers were contrived vertically above each other, so that the descending liquid and ascending vapours would move in opposite directions—a necessary condition in such works.

The disadvantages of this vertical arrangement of the boilers are—

1. Direct fire heat cannot be applied. It becomes necessary to introduce high-pressure steam into the liquid, causing a mixture of this steam with the vapour distilled.

2. The liquid to be distilled must be pumped to a certain height before it can flow into the apparatus.

3. The apparatus is difficult to get at to examine its condition internally.

The exclusion of direct fire heat is often exceedingly inconvenient; besides rendering a steam-boiler necessary in places where it is probably of no further use, the employment of steam in this case is less economical.

The apparatus of E. Solvay offers very special advantages for distilling ammoniacal gas liquor. It is constructed to work horizontally, and is heated directly. It also has the advantage of producing a constant motion of the whole fluid mass, by the vapours of distillation being themselves forced through the fluid. It is convenient and not expensive in its arrangement, can be economically worked, is perfectly regular in its operation, and is independent of any special skill in the workmen employed.

The apparatus is particularly remarkable for the principle on which it is constructed, by which the vapours of distillation themselves force on the liquid to be distilled, in a horizontal direction opposite to that of the vapour.

If a gas or vapour rises in a narrow vertical tube, it will raise with itself a certain portion of the liquid, and if the volume of the gas is sufficiently great in proportion to the liquid, and rises with sufficient velocity, the liquid may be raised to a considerable height—greater than it would be by the mere pressure of the gas or vapour, even if this pressure is not perceptibly diminished. This latter circumstance is of especial importance if the apparatus is used for washing or absorbing gas, when loss of pressure is to be avoided.

The apparatus is represented in figs. 1 to 4.

It consists of a boiler, A, divided by the partitions, C, into a certain number of divisions, B_1 to B_{13}. Each division contains a jar-shaped cast-iron vessel, E, connected with the succeeding division, so that the liquid can flow into the latter by the lateral aperture, while the vapour from the *preceding* division enters the same vessel, E, through the bent tube, T. The fire is applied at F.

The apparatus, therefore, works as follows:—The level of the liquid being the same throughout the whole apparatus as far as O, the liquid to be distilled is warmed in the vessel R (which will be explained presently). The warmed liquid passes from R, through the pipe M, into the apparatus A—namely, into the division B, and from thence into the vessel E_1; the vapour produced in the division B_1 also passes through the bent tube, T, into E_1. But this vapour forces a portion of the liquid over the edge of the vessel E_1 into the division B_1, from whence it can pass into E_2. In the same way the vapour from B_2, entering E_2, forces the liquid into B_3, and thence into E_3, and so on till it reaches the division B_{13}, from which the exhausted liquor runs off through the pipe U, while the products of the distillation escape through the tube V.

If it is required to wash or absorb gas, the gas must be admitted into B_{13}, while the purifying or absorbing liquid flows in through B.

The progress of the liquid in the apparatus depends upon the relative diameters of the bent tubes, T, and the vessels, E. The circular space between the bent tube and the edge of the jar, E, must be duly proportioned to the quantities of liquid and of gas which are required to pass.

R is a condenser for the vapours distilled. Passing through the worm, J, they are cooled and condensed by the liquid to be distilled, and which enters cold from the reservoir, K, into a small apparatus, G, whence its admission into R is regulated by a valve, S, which is closed or opened by the float, X. According as the liquid is more or less warmed the float falls or rises, and allows more or less of the liquid to pass, so that the more heat is applied, and the more vapour is produced, the more liquid can flow in through the valve S. This float will also act if the products of the liquid to be distilled are variable.

Q is a small washing apparatus for cleansing incondensable gas before it escapes.

It is to be noted that the float prevents the entrance of any more liquid when the fire is put out, for there is then no product of distillation, the liquid in the condenser remains cold, the float rises and the valve closes, while as the condenser is warmed by distillation the float sinks, and the valve is opened.

The apparatus, as shown in the drawing, is also applicable to the distillation of gas liquor. The product is a concentrated gas liquor of uniform strength, the quantity of ammonia being equal to about 15 per cent. of caustic ammonia. The apparatus employed will distil, in 24 hours, 12, 24, and 48 cubic mètres of gas liquor of 2° to 3° Beaumé. A concentrated product is obtained containing 15 per cent. of ammonia. The consumption of fuel varies from 25 to 30 kilogrammes of coal for each cubic mètre of raw gas liquor.

With very weak gas liquor, the steam of the portion distilled is utilized to warm the gas liquor as much as possible before entering the apparatus. As gas liquor always contains a variable quantity of solid ammoniacal salts in solution, a special lime apparatus, to be connected with the still, is requisite to recover the ammonia of these salts. In the distillation, carbonic acid and sulphuretted hydrogen first pass off with ammonia, the water in the still then containing only a small quantity of caustic ammonia. When this is distilled, the water is mixed with the requisite quantity of lime in the lime apparatus, and immediately redistilled, without in the slightest degree interfering with its continuous working.

To produce ammonia, sulphate or chloride, it is only necessary to pass the vapour, or the concentrated gas liquor, into sulphuric or hydrochloric acid. The vessel, R, is then made to warm the liquor to be distilled, by conveying the heated residual liquor from the division B_{13} through the worm.

If the apparatus is used for absorbing gas or vapour, the float must be arranged to work reversely in R, as a larger supply of liquid will be required the more rapidly the gas is absorbed, only care should be taken that the liquid never reaches too high a level.

There is no doubt that Solvay's ingenious apparatus is capable of varied application, and that it forms a real step in advance.

ON THE VOLUMETRIC DETERMINATION OF SULPHUR AND AMMONIA IN ILLUMINATING GAS, WITH A DESCRIPTION OF THE APPARATUS EMPLOYED.*

By H. E. Sadler and B. Silliman, of New Haven, Conn.

The research here recorded was undertaken early in the present year and has been prosecuted steadily for about eight months. While the work has been under my constant supervision and advice, the labour has all been performed by Mr. Sadler, to whom is chiefly due the development of the successive steps which have led to the final result. The process is better than I dared to hope, and we are able to place at the command of chemists and engineers interested in the matter an apparatus of continuous and uninterrupted action, and methods of analysis by which the daily averages of the two variable and inconstant factors of illuminating gas, ammonia and sulphur, may be determined with all needful accuracy, even by those little skilled in chemical manipulation, and with very little loss of time.

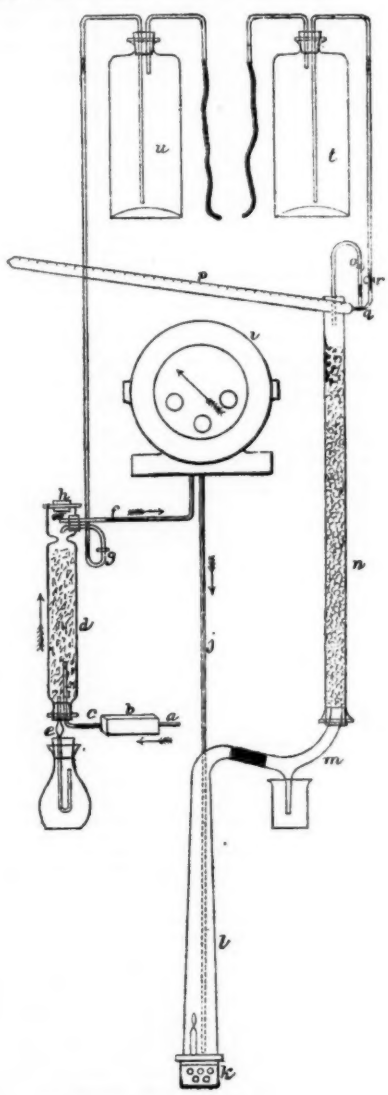
This research has been carried out in the laboratory of the New Haven Gaslight Company.

Oct. 17, 1876. B. Silliman.

Introduction.

In making some determinations of the sulphur in coal gas by the Letheby apparatus, the importance of some simpler process was forcibly suggested by the experience, skill, expense, and time required to obtain trustworthy results. The chances of error were numerous. Insufficient washing of the apparatus, with the liability of breakage in daily handling, the care required in the concentration and in the expulsion of the ammonia, the varying solubility of barium sulphate in presence of indefinite quantities of ammonium nitrate and free acid, the tendency of that precipitate to run through the filter, the opportunities for loss in the incineration and ignition, the expense of the analytical balance, with the delicacy of manipulation which it requires, and, above all, the time involved—from four to eight hours after the gas is burned—all these seemed to place the Letheby test beyond the possible for the practical gas manager.

To escape these numerous drawbacks, without the sacrifice of accuracy, was the end proposed. The result attained is a simple process for the volumetric estimation of the sulphur, dispensing with the balance, and requiring but ten minutes for a determination. The apparatus at the same time affords the working engineer a continued and ready check upon all his purifying processes except the removal of the tar.



Description of the Apparatus.

The apparatus represented in the accompanying drawing is of glass, except the governor, *b*, the meter, *i*, with its connexions, and the burner, with its case, *k*, which are of metal: *d* performs the office of a scrubber. It is an inverted calcium chloride or bubbling tube, of about 600 cubic centimètres capacity, with a third hole drilled for the admission of the stopper, *h*, which carries a wire to support ammonia, acid, and hydrogen sulphide test papers. The larger cylinder is filled with broken glass, and supplied with standardized acid from the bottle, *u*, by means of the syphon-tube, *g*, which is fitted with a stopcock. The gas is admitted by the tube, *c*, extending 5 centimètres into the cylinder, and the acid escapes into a flask below by the tube *e*, which is bent to form a seal. The meter and burner are substantially those used by the Referees.* The adapter or eductor, *l*, is 50 to 60 centimètres high, the diameter at the base about 7 centimètres, and the smallest internal diameter at least 1½ centimètres: *m* has a diameter of 2 centimètres, with an opening drawn out at the bottom for the escape of the drip from *n*: *n* is a strong tube 3½ centimètres in diameter by 80 centimètres long, filled with glass marbles 1½ centimètre in diameter. This tube serves as a condenser, and also to break up the ascending current from the burner, and bring it into intimate contact with a standard alkali, dripping upon the marbles through the tube and stopcock, *o*, from the pipette, *p*. This measures 200 cubic centimètres by halves, and is 60 centimètres long. At the beginning of an experiment it is filled by the three-way pipe, *q*, from the bottle, *t*, by opening the pinch-cock, *r*.

The apparatus is most conveniently mounted against the wall; the meter and bottles standing upon shelves, and the burner and beakers upon swinging brackets. The remaining parts are then secured by clamps driven or screwed into the wall.

Mode of Manipulation.

Solutions of caustic soda or potash and an acid, sulphuric or oxalic, are provided of such strength that one cubic centimètre has a saturating power exactly equal to 1-10th of a grain of sulphur in the form of sulphurous or sulphuric acid.† The containing-bottles and the pipette being filled, the gas is lighted and regulated by the governor, as near as may be to the rate of 10 feet in 24 hours. The stopcocks in *o* and *g* are then opened, so that 10 cubic centimètres will pass each for one foot of gas burned.‡ After half an hour or an hour, when the apparatus has attained its normal working, a clean flask is placed under each drip, while the meter and the quantity of alkali solution in the pipette are accurately noted.

When, thereafter, 10 feet have passed the meter, which will be in about 24 hours, the quantity of alkali which has flowed from the pipette is determined, and the flasks are removed, others being substituted if a test is desired for the following day.

The free and carbonated alkali present in the drip is then to be saturated with the standard acid; but since with litmus, and even with cochineal,§ the carbon dioxide obscures the point of neutralization, it is best to add a quantity of acid equal to the total alkali used, and after removing the carbon dioxide by boiling the liquid for a brief interval, to titrate back with the standard alkali. The number of cubic centimètres so used expresses the number of grains of sulphur in 100 feet of gas. For the alkali received in the drip being just saturated by the standard acid, the free acid there will be the quantity caught from the gas. Now, since one cubic centimètre of the alkali finally added is saturated by 1-10th of a grain of sulphur, 1-10th of the cubic centimètres added indicates the number of grains caught from the 10 feet burned, and ten times this, the quantity of sulphur in 100 feet.

The acid solution used in the scrubber is also measured, and the acid remaining free determined by the standard alkali. The difference expresses, as in the case of the sulphur test, the number of grains of sulphur which can be neutralized by the ammonia in 100 feet of gas. Since one grain of sulphur neutralizes 1 1-16th grain of ammonia, if the number of cubic centimètres of acid neutralized by the ammonia be increased by 1-16th, the sum will express the grains of ammonia in 100 feet. This may be accomplished mechanically by having the ammonia measuring-glasses graduated so that 17 divisions shall be equal to 16 cubic centimètres.

The conditions indicated are the most convenient for continuous daily determinations. They are not essential to successful working. On the contrary, 2 feet of gas are sufficient to give reasonably accurate results, and the apparatus has not proved unequal to a rate of one foot per hour. Moreover, much less acid run through the scrubber would be usually sufficient. The quantity of ammonia to be arrested during the period of these experiments was abnormally large, pending a rearrangement of the scrubbers at the works.

Efficiency of the Apparatus.

The following results were obtained from an apparatus which differed from that figured only in that the eductor, *l*, and the condensing-tube, *n*, were each one-third shorter than described. It was worked first in comparison with the Letheby test, taking the gas from the same supply-pipe, and burning it during the same interval, at nearly the same rate—about two-thirds of a foot per hour. From 2 to 4 feet, according to convenience, were taken for each experiment. ‖ The Letheby was supplied with about 100 cubic centimètres concentrated liquor ammonia. However, this rule was not invariable, and, with three or four of the experiments, which cannot now be specified, a weaker solution was used. No result, however, is reported, or was worked out, in which at the end of the burning an exposure of three seconds at the escape failed to turn turmeric paper deep brown. The condensations and washings were evaporated in the water-bath to about one-half, acidified with bromine, heated to expel any great excess, precipitated while boiling with barium chloride, allowed to settle, the supernatant liquid, and finally the powder, decanted on to a filter, washed with hot water so long as the washings showed the presence of

* A paper read before the American Institute of Mining Engineers at the Philadelphia Meeting, Oct., 1876.

* First Report of the Gas Referees upon the Sulphur Question, July 13, 1870. Reported in the London Journal of Gas Lighting, &c., Aug. 16, 1870.

† The standard solutions can be purchased of chemical dealers, and no balance will then be needed. They may conveniently be made of ten times the strength indicated, and portions withdrawn and diluted to this strength as required.

‡ Great difficulty was experienced in securing an uninterrupted and uniform flow of the solutions. The purest distilled water seemed to carry down impurities sufficient to choke the capillary opening of the stopcocks, which at the proper rate pass but four drops per minute. Filters of Swedish paper, of cotton batting, of fine linen cloth, and of sand, were tried in vain. The simple device of passing the solution through the stopcocks in ascending instead of descending currents, which placed the force of gravity in opposition to, instead of in accord with, the slow suction of the streams, afforded instant and complete relief.

§ Hæmatoxylin was first chosen as an indicator, both because it is the most sensitive to minute quantities of free acid and alkali, and because the change of colour, yellow to port wine, is the most conspicuous. But in this solution the reaction was very unsatisfactory. The colour changed gradually from yellow to reddish-brown. The absence of metallic salts, at least of the heavy metals, was well demonstrated, and there seemed no explanation of the phenomenon, except that the colouring matter was oxidised by the nitrous acid present and rapidly destroyed. Cochineal was therefore substituted, and proved very satisfactory.

‖ It may be remarked that in the Letheby test, as described in Sugg's "Gas Manipulation," the gas is burned in an atmosphere strongly ammoniacal. The products of combustion are carried into a large glass cylinder, where the resulting ammonium sulphite and sulphate fall with the condensing vapour of water, passing into solution. The sulphur is then converted into the form of barium sulphate, and weighed. In the apparatus used, a second condensing cylinder was added, and a trial with a further addition of ten feet of tubing, as a condenser, showed that less than one-half of 1 per cent. of the liquid escaped.

barium, dried, ignited, and weighed, the filtrate being always tested for sulphuric acid.

The other apparatus was supplied with from 9 to 12 cubic centimètres of the standard soda solution for each foot burned. The gas was taken direct from the governor to the meter, without the interposition of the ammonia test, and the drip having been slightly acidified with hydrochloric acid, and further with bromium water, was boiled, and the contained sulphates precipitated hot with barium chloride, and treated thereafter as in the Letheby determinations.

The following table gives the results:—

TABLE A.

Date	Sulphur Caught. Grs. per 100 Ft.	Sulphur Caught by Letheby. Grs. per 100 Ft.	Excess over Letheby. Grs. per 100 Ft.
May 15	18·64	12·44	6·20
„ 16	19·62	13·70	5·92
„ 17	18·54	14·01	4·53
„ 22	19·33	12·38	6·95
„ 23	18·15	12·11	6·04
„ 24	17·64	11·64	6·00
„ 25	16·58	13·04	3·54
„ 26	14·25	10·21	4·04
„ 27	18·43	10·47	8·43
Total	161·65	110·00	51·65

Average gain over Letheby . . . . 46·95 per cent.

The only means at hand for comparing the new apparatus with the Referees is through the Letheby. In their description of their test, before referred to, a table is given in which the following determinations only are strictly comparative:—

TABLE B.

Referees. Grs. of Sulphur per 100 Ft.	Letheby. Grs. of Sulphur per 100 Ft.	Excess. Grs. of Sulphur per 100 Ft.
33·4	25·1	8·3
35·5	24·4	11·10
32·6	22·2	10·4
31·8	23·8	8·00
29·2	23·9	5·3
29·6	24·9	4·7
31·17	24·9	6·27
31·4	25·4	6·0
32·27	25·8	6·47
32·8	25·24	7·56
31·6	24·32	6·28
32·96	23·96	9·0
34·41	23·35	11·06
35·0	21·86	13·14
34·73	24·92	9·81
34·98	25·82	9·16
34·8	25·24	8·56
35·5	25·4	10·1
36·26	25·12	11·14
27·4	18·4	9·0
28·0	19·2	8·8
27·7	23·3	4·4
26·6	20·6	6·0
28·03	20·4	7·63
379·85	577·53	197·68

Average gain over Letheby . . . . 34·2 per cent.

And in the place cited, Dr. Odling reports the following comparative workings:—

TABLE C.

Referees. Grs. of Sulphur per 100 Ft.	Letheby. Grs. of Sulphur per 100 Ft.	Excess. Grs. of Sulphur per 100 Ft.
26·41	21·04	5·37
25·60	19·32	6·28
21·33	19·76	1·57
21·04	17·48	3·56
94·38	77·60	16·78

Average gain over Letheby . . . . 21·6 per cent.

A comparison of these workings seems to indicate that in efficiency this apparatus does not differ materially from that of the Referees; for while the per centage of gain over Letheby's is considerably larger, it will be noticed that the quantity of sulphur to be caught was less, and the actual number of grains caught in excess of the Letheby is in favour of the Referees test. Perhaps no apparatus arrests absolutely all of the sulphur, and the real usefulness of sulphur tests consists in indicating the relative amounts of sulphur in the gas from day to day. A consideration of these tables forces upon one a conviction of the entire worthlessness of the Letheby test for even this purpose, a defect which the experience and carefulness of Dr. Odling himself has not overcome. A third sulphur test is that of Mr. F. J. Evans, who drew the products of combustion through an alkaline solution contained in Woolfe bottles. It is to be regretted, in this connexion, that no figures could be obtained showing the result of his workings and affording a comparison of the new test with his, and that no opportunity has been offered to compare its simplicity or accuracy with the test devised by Mr. Vernon Harcourt, and described at the last meeting of the British Association of Gas Managers.

Volumetric Estimation of the Sulphur.

Having so far demonstrated the efficacy of the new apparatus, the Letheby test was discarded, and the determinations of the sulphur hereafter given were made by precipitating the sulphur in the drip from the new apparatus by barium chloride, in the manner already described. The apparatus was not changed, except to introduce the tube *d*, to arrest the ammonia which, previously passing through the flame in undetermined quantities, had vitiated the volumetric estimations of the sulphur acids by standard alkali solution. The alkali used was caustic soda. For the scrubber, standard sulphuric acid was chosen on account of its slight volatility, and in order that the absorption of acid vapours by the gas, then deemed possible, might not complicate the results by introducing a new acid into the products. To saturate the alkali in the drip, standard hydrochloric acid was chosen, as it permitted a gravimetric estimation of the sulphur in the portion taken after it was titrated, avoiding alternate sources of error, either the estimation of the total sulphur introduced with the sulphuric acid, or obtaining two separate portions of the drip, having in solution exactly equal quantities of acid and of sulphur. Moreover, though free hydrochloric acid is somewhat volatile in boiling solution, experiment demonstrated that, with the degree of dilution and heat employed in these determinations, the loss was unappreciable. A 100 cubic centimètre pipette, and a burette measuring 100 cubic centimètres by tenths, were used for supersaturating the alkali with acid, and a 25 cubic centimètre burette graduated to tenths for titrating back with the soda. For each determination a portion of the drip resulting from the combustion of from 6 to 10 feet of gas was taken, divided into two measurably equal portions, and duplicate experiments carried through, as shown in the following table, the results being calculated to grains in the hundred feet:—

TABLE D.

I. No.	II. Date.	III. Acid caught per 100 Feet, expressed in Grains, Sulphur.		IV. Grains of Sulphur caught per 100 Feet.		V. Excess of Acid.	VI. Excess of Sulphur.	VII. Excess of Acid Corrected.	VIII. Soda, Cubic Centimètrs. per Foot of Gas burned.	IX. Rate. Feet Burned, 100 Min.
	Aug.									
1	22–3	38·55 / 38 65	38·60	39·34	39·34	..	0·74	−0·74	7·90	1·864
2	23	46·91 / 46·58	46·74	41·33 / 41·42	41·37	5·37*	..	(−0·10)	9·75	1·026
3	23–4	35·99 / 35·93	35·96	35·28 / 34·76	35·02	0·94	..	+0·94	12·28	1·023
4	24	30·55 / 31·25	30·90	33·95 / 32·46	33·20	..	2·30	−1·21	13·67	1·056
5	24–5	35·28 / 36·01	35·64	34·48 / 32·60	33·54	2·10	..	+0·60	10·65	1·041
6	25	36·61 / 35·95	36·28	34·55 / 34·23	34·39	1·89	..	+1·89	12·80	1·026
7	28	34·20 / 34·29	34·20	35·50 / 35·37	35·43	..	1·23	−1·23	9·44	1·035
8	29	38·98 / 38·98	38·98	39·53 / 39·62	39·58	..	0·60	−0·60	11·70	0·996
9	30	36·01 / 35·68	35·84	35·80 / 35·22	35·51	0·33	..	+0·33	13·33	0·984
10	30–1	33·27 / 32·91	33·09	32·25 / 31·96	32·11	0·98	..	+0·98	9·90	10·22
	Sept.									
11	31–1	33·63 / 33·79	33·71	34·38 / 33·86	34·12	..	0·41	−0·41	10·87	0·987
12	1–2	35·84 / 35·54	35·69	33·91 / 33·74	33·82	1·87	..	+1·87	9·95	0·988
13	2–3	34·87 / 35·00	34·93	33·06 / 33·06	33·06	1·87	..	+1·87	10·99	0·966
14	3–4	31·92 / 32·58	32·25	31·40 / 31·44	31·42	0·83	..	+0·83	10·79	0·944
15	4–5	31·90 / 32·07	31·98	30·09 / 30·30	30·20	1·78	..	+1·78	10·20	0·957
16	5–6	26·03 / 26·51	26·27	26·46 / 26·91	26·68	..	0·41	−0·41	9·65	0·940
17	6–7	24·81 / 24·81	24 81	24·36 / 24·33	24·35	0·46	..	+0·46	10·47	0·943
18	7–8	22·36 / 22·36	22·36	20·12 / 20·27	20·20	2·16	..	+2·16	13·19	0·897
19	8–9	18·43 / 18·44	18·43	18·92 / 18·93	18·92	..	0·49	−0·49	10·75	0·960
	Average errors					1·29	0·75	..	..	..
	Average total error					0·27	..	..	..	..

* An error of 2 c.cms., in determining the quantity of alkali used, would have made this result—0·10. An exactly similar error in experiment No. 15 was discovered in time to be corrected. At all events, this result is so abnormal that it seems proper to disregard it. It will be noticed that, throughout, the duplicate experiments accord fairly with each other. In two instances, however, they differ by more than 1 grain per 100 feet—viz., in experiments Nos. 4 and 5. It is probable, since they cannot both be nearly right, that one is entirely wrong, and therefore, in computing column VII., only that result is taken which is most in accord with the other experiments.

It will be seen by comparing columns III. and IV. that the acid caught indicates the quantity of sulphur in the gas with tolerable accuracy, sufficient for all manufacturing purposes. Columns V. and VI. give the excess of acid and sulphur in terms of grains of sulphur to the hundred feet. The average error in favour of the acid is 1·29 grain, and in favour of the sulphur, 0·75 grain, making the average total error 0·27 grain in favour of the acid. Assuming this as a constant quantity, which, being deducted from the acidity found, gives the sulphur, we have as a limit of error in favour of the sulphur (No. 4) 2·03 grains, in favour of the acid (No. 18) 1·89 grain. We may say, then, that one grain to the hundred feet is the average error, and two grains the limit of error for the volumetric determination of the sulphur in gas by this apparatus.

(To be continued.)

SWINDON NEW GAS COMPANY, LIMITED.—The half-yearly meeting of shareholders was held on the 24th ult. The revenue account showed that the receipts had been £1225, and the expenses £978, leaving a profit of £247, out of which a dividend at the rate of 9 per cent. was declared. The company was started about 14 years ago, with a capital of £2500, but the marvellous growth of New Swindon has required many extensions of plant, so that the amount of capital issued to the present time is £5575. A new gasholder, 60 feet by 40 feet, has just been completed, and the prospects of the company are very encouraging. A reduction of 5d. per 1000 was made in the price of gas last June.

PROPOSED PURCHASE OF THE ILKESTON GAS-WORKS.—At a meeting of the Ilkeston Local Board, on March 8, the clerk read a letter from Mr. B. Wilson, secretary to the directors of the Ilkeston Gas Company, stating that a meeting of shareholders had been held to consider the offer of the board to give £12 per share for each registered share for the company's plant, &c., and that they declined to sell their works at the price named. It was stated that at the shareholders meeting it was proposed and seconded that the plant, &c., of the company be sold to the board at £12 per share, that price being considerably more than the original cost of the shares. On being put to the vote there were 31 votes in favour of the sale and 99 against it.

DERBY WATER-WORKS COMPANY.—The half-yearly meeting was held on the 27th ult.—Mr. Gascoyne in the chair. The report of the directors stated that the gross receipts from revenue amounted to £6171 11s. 2d., being £440 more than in the corresponding half year of 1875. The revenue expenditure amounted to £3417 13s. 4d., being £599 18s. 8d. more than that of the corresponding half year. The net profit realized was £2753 17s. 10d. available for dividend. The directors recommended the usual dividends of 10 and 7 per cent. respectively, amounting to £4739 8s. 1d., as against £3767 11s. 3d. in the corresponding half year, leaving a deficiency of £1985 10s. 3d., which would be supplied from the contingent and suspense funds. These funds, after supplying this deficiency, would still amount to £4956 19s. 2d. The cause of the deficiency arose partly from the increased dividends on further capital expended in the past year, the extra cost of coals, wages, and repairs to works and buildings. The engines, boilers, and the whole of the property generally were in good working order and condition, and quite satisfactory to the company's engineers.

GAS AFFAIRS IN AMERICA.

REPORT OF THE GAS COMMISSIONERS IN RELATION TO THE SUPPLY OF GAS TO THE CITY OF BOSTON.

(*Continued from p.* 386.)

Now, to compare results under the same method of getting at the supposed cost of the product of the Boston Gas Company:—

	Dols.
10 per cent. dividends on capital, 2,500,000 dols.	250,000
6 per cent. interest on bonds, 500,000 dols.	30,000
Taxes on 4,426,000 dols. say	66,400
With delivery of 631 million cubic feet	346,400
Gives for each 1000 cubic feet, say	0 55
Average price of gas for 1875	2 50
Less for street lights and discounts	0 10
	2 40
Per 1000 cubic feet	1 85

And we find the supposed cost exceeding that of the New York Mutual by 34 cents per 1000 cubic feet.

This difference of cost of manufacture would seem too large to be passed over, without explanation by the Boston Gas Company, and we find the same upon comparing the four items of cost of coal, labour, distribution, and receipts for residuals, all of which items are in favour of the New York Mutual Company.

The Boston Gaslight Company do not, and probably cannot, for the reasons stated above, so long as they use coal alone, make gas as cheaply as the New York Mutual Company; but with an increase of 1000 cubic feet in the yield of coal per ton, which they have shown themselves capable of making—so that instead of 9572 cubic feet in 1875, about 10,500 were obtained in three months of 1876—a diminution in the cost amounting to about 8 cents per 1000 cubic feet is gained. With this increase in the yield, the illuminating power has been about 17½ candles. This diminution in the cost of the gas, arising from the increased yield, would naturally be accompanied by a corresponding diminution in the labour, and wear and tear of works and apparatus; so that we are firmly of the opinion that, with due consideration of the cost of the plant, and with proper economy in the manufacture of gas, even with the prices of coal for 1875, a superior article of gas can be made and delivered in Boston, if the prices were uniform and no discounts allowed, for between 1·50 dol. and 1·60 dol. per 1000 cubic feet, and with an additional 50 cents per 1000 cubic feet to cover the cost of taxes and interest on bonds, together with 10 per cent. on the capital, the citizens in that part of Boston now supplied by the Boston Gaslight Company should be in receipt of gas of 17 or 18-candle power for 2·00 dols. or 2·10 dols. per 1000 cubic feet, and we have heard it asserted by the manager of a large gas-works, that the price of gas must soon find its level at 2·00 dols. in our large cities, for gas of 16-candle power.

And in proof of the capability of improvement in the manufacture of gas in Boston, we may say that in 1876 the figures of the Boston Gas Company show a diminution in the cost of labour of several cents per 1000 cubic feet, and an increase of about 1000 cubic feet per retort in the 24 hours, as well as 1000 cubic feet more per ton of coal.

The Gaslight and Coke Company (Chartered) of London, distributing about 6½ times the quantity of gas that the Boston Company does, gives the total cost of manufacturing, including every charge, except the cost of coal, at 39·1 cents per 1000 cubic feet, and the total cost of the gas, less residuals, at 88 cents per 1000 cubic feet, or to add to that their receipts for the ammoniacal liquor, not utilized here (5·7 cents), we have 93·7 cents as the total cost. In regard to the London companies, it must be remembered that labour is much cheaper, and that a greater price is obtained for residuals than is possible in this country at present. The price of coal, however, was not very different in 1874, being about five cents less per 1000 cubic feet of gas sold.

After a careful inspection of the New York Mutual works, and the process of manufacturing gas there used, it was thought advisable to compare the same with the works of a similar character in other cities; and for this purpose we obtained letters to the President of the Chicago Mutual Company, who received us courteously, gave us all information asked for, and allowed us to examine the process of manufacture at our leisure. Here we found that, under an Act of Legislature, the price of gas was fixed at 3·00 dols. per 1000 cubic feet, and as the city was districted between the People's and the Gaslight and Coke Company at this price, there was no competition, and consequently no such incentive to make a superior quality of gas as exists in the City of New York. Atmospheric air was made to form a large ingredient in the commercial gas delivered to the consumer, who had no alternative but to take such as he could get. The delivery of the Chicago People's Company is about 300 million cubic feet per year, through about 160 miles of pipe on the western side of the river. Coal cost about 6·00 dols. per ton, and yielded about 10,000 cubic feet per ton. This was enriched by 33 per cent. of naphtha gas, which was itself diluted by 40 per cent. of atmospheric air, thus forming a commercial gas of 66⅔ per cent. of coal gas, 20 per cent. of pure naphtha gas, and 13⅓ per cent. of air.

This district was supplied with gas of a fair quality, the illuminating power being from 17 to 18 candle power, and the specific gravity being 0·498. The amount of ammonia was quite large, being over 14 grains in 100 cubic feet. The naphtha, stored in iron tanks underground, was fed therefrom to the stills, which were iron drums about 6 feet by 8 feet, with steam coils passing through them, so as to vaporize the naphtha. This vapour was carried through a 2-inch iron pipe, as in the New York Mutual works, to the red-hot retorts, where it was decomposed to a fixed gas, and thence passed to the exhauster and mixed with the purified coal gas. The two gases were not measured separately before being mixed. In the corner of one of the rooms at the works a jet was kept burning, and, by the colour and appearance of the flame, one of the workmen judged of the amount of air necessary to add to the naphtha gas, in order to keep the mercantile gas uniform in quality. The coal gas was made in the usual manner, washed and purified with dry lime, and mixed with the diluted naphtha gas before going to the holder for distribution. The scientific accuracy which was noticeable at the New York Mutual works was not manifest here. The gas burned well, but was not remarkable for its purity, which, however, may be explained by the fact that a new purifying-house was in process of erection, the old one having been found insufficient to meet the demand of so large an amount of gas.

The practice of charging the naphtha gas so heavily with air, as has been already mentioned, does not recommend itself to our judgment, as of any further benefit than to increase the quantity at the expense of the quality of the gas.

Here, as at other works using naphtha, we found a very material advantage over the coal gas companies in the item of labour, since, while the coal requires much handling, the former feeds itself to the retort, which is kept closed, and requires but little other attention than to feed the furnace fires. The two benches of naphtha retorts here in use were said to furnish as much gas as 20 coal retorts. Naphtha was somewhat cheaper than in New York, costing only 4½ cents per gallon. The leakage ranged from 7 to 9 per cent.

On the other side of the river, the district is controlled by the Chicago Gaslight and Coke Company, which distributes about 400 million cubic feet of gas through about 100 miles of pipe main. This company claims to make about 10,000 cubic feet of 17-candle gas from a ton of Westmoreland coal without any enricher, by the use of the M'Ilhenny dip seal. The same result has been claimed by the Charlestown (Mass.) Gas Company; but we have not found the process extensively used, or generally in favour with gas companies. This company, from the frequent laying of sewers and raising the grade of the streets, suffers a leakage of about 25 per cent., and yet continues to pay a dividend of 10 per cent., and has built new works from its surplus earnings. The illuminating power of the Chicago gas averages about 17 candles, but was a little richer than this at the time of our tests. The specific gravity of the gas was 0·455, and there was but a small amount of ammonia and sulphur. The Chicago Gaslight Company have a capital of 2,300,000 dols., and have 1,200,000 dols. bonds out. This company use no naphtha or petroleum.

At Detroit we found both companies using naphtha; the Detroit Mutual Company using it by the Gale and Rand process. We examined the works of this company, which are well located, and rank well in character with other works visited. They cost, including 45 miles of mains, about 700,000 dols. Here we found quite a radical change in the method of manufacturing gas. While in New York and Chicago, 33 per cent. of mixed naphtha gas and air was considered to be as large a per centage as could be used to advantage, we saw here a single bench of retorts only used for making coal gas, and another bench for naphtha gas. To the latter, the naphtha vapour was conducted from steam drums, as at Chicago, and from these two benches it was stated that about 60 million cubic feet of gas were supplied annually. The naphtha, costing 3½ cents per gallon, produced about 140 cubic feet of mixed naphtha gas and air (half and half) per gallon; and this mixture constituted, at the time of our visit, about two-thirds of the total bulk of the mercantile gas, one-third only being produced from the coal bench; and it was stated that this could be dispensed with, were it not that the coke from the coal retorts was necessary for heating the naphtha retorts, which require a steady heat, which cannot so well be obtained from coal as fuel. The air is charged in studied proportions into the naphtha gas, so as to keep the commercial gas at about 20 candles. The mixed naphtha gas and air, and the coal gas are measured separately before being mixed. The coal used was small coal, costing about 3·50 dols. per ton, and the purifier used was the iron mixture, which consisted of the sulphate of iron, sawdust, and lime. The specific gravity of the gas was about 0·800, so that a very high pressure was required at the works, in order to have the requisite pressure at the burner.

We afterwards visited the works of the Detroit Gaslight Company, in company with the secretary. Up to within a week they had been supplying coal gas alone, but at this time were, for the purpose of competing successfully with the Mutual Company, making, in addition to their coal gas, a certain amount of "wood gas," which was enriched with naphtha gas. They estimated the yield from the wood to be 30,000 cubic feet per cord, which cost 3·50 dols., or about 40,000 cubic feet from a cord of wood and two barrels of naphtha. This mixture was, without being purified, mixed with the coal gas. This company has about 60 miles of pipe, and supplies about 125 million cubic feet annually to about 1500 consumers, charging 2·75 dols., and 3·00 dols. per 1000 cubic feet to those consumers outside of the district occupied by the pipes of the Mutual Company.

Inasmuch as the competition between these rival companies has now continued for three years without any prospect of adjustment, we may well suppose that, with the low rates of 0·50 dol. and 1·00 dol. per 1000 cubic feet, there is no incentive to make a superior gas; so that about all that we can say in praise of the unpurified wood gas enriched with naphtha, is to repeat the words of some of the officers of the company, who stated that it was "very good fighting gas."

We found naphtha in use as an enricher for coal gas in but one other large works—viz., at Lowell, Mass. This we were somewhat surprised to find after the prolonged hearing before the Lowell Board of Aldermen, and the persistent opposition to the establishment of a naphtha gas-works in the city. This opposition would, however, probably have been as persistent against the establishment of any competing company. Here we found new works of a superior character, with all preparations for the continued use of naphtha as an enricher of the coal gas. The naphtha gas, after being measured, was passed to the hydraulic main of the coal gas, with which it was washed and purified. This probably removed a portion of the rich hydrocarbons, and detracted somewhat from the value of the naphtha as an enricher. Notwithstanding this, the officers consider that the use of the naphtha had resulted in a considerable saving to the company; and they have been able, with a distribution of only about 71 million cubic feet (without the naphtha, from July 1, 1874, to June 30, 1875), and a price of 2·50 dols. (the same price as in Boston) per 1000 cubic feet, to pay to the stockholders a clear dividend of 10 per cent. on the capital. The price was reduced to 2·25 dols. on Jan. 1, 1875, three months before the same reduction was made by the Boston Company. At the same time, the district supplied is not so compact a one as that supplied by the Boston Company, since only 1,747,043 cubic feet are sold per mile of pipe, against 5,633,928 cubic feet in Boston; and, again, the transportation of coal by rail from tide water adds 1·00 dol. per ton to its cost. As an off-set to these disadvantages, there is no discount allowed to any consumer, and a somewhat higher price is obtained for residuals; so that the total cost of manufacture per 1000 cubic feet of gas sold was a little less than at the Boston works in 1875.

We found in the works of the Citizens Gaslight Company, of Brooklyn, N. Y., that crude petroleum was used in the same way that cannel coal is used in coal gas-works—*i.e.*, mixed mechanically with the coal before the latter is thrown into the retort, by which means it was considered that about 10 per cent. on the cost of the gas was saved, 12,000 cubic feet being obtained from a ton of coal mixed with about 2½ per cent. of petroleum. This statement, however, was not verified by an examination of the books.

In the previous year (1874) this company manufactured water gas by the Gwynne-Harris process, and mixed this with their coal gas. It is probable, however, that by this method a large amount of carbonic anhydride was made, since the specific gravity of the resulting gas was between 0·700 and 0·800. On this account the consumers used a smaller quantity, and their bills were much less; and for this reason, it was said, the directors of the company ordered a cessation of the process, and a return to coal gas, the result of which has been, according to the president, that 50,000 dols. worth more gas has been sold than during the corresponding period of 1874, when the water gas process was in use, but the net profit has been 8000 dols. less.

About the same method had been used by the People's Gaslight Company of Brooklyn, N. Y., and was discontinued for the same reason by the directors, some of whom were also directors of the Citizens Company.

We need say but little of the various works visited, in which pure coal gas was manufactured, except that at none of them did we find gas of so good a quality manufactured as at the Boston Gas-Works. The Manhattan Company's gas, of New York, has about the same quality as the Boston gas, and at the time their gas was tested by us, it was fully equal to the Boston gas. It averages, however, about 17 candles, while the Boston gas averages about one candle higher. At the same time it must be remembered that the price of gas is 25 cents per 1000 cubic feet higher than in Boston. The gas of the Metropolitan New York Gaslight Companies of New York City averages from 16 to 16½ candles, and the Philadelphia gas about 16½ candles, although at the time of our visit to Philadelphia it happened to be 18¾, a result which was obtained not only by us, but by another observer, not connected with the company, in a different part of the city. The gas of the Chicago Gaslight and Coke Company has an illuminating power of about 17 candles. Of the companies in the vicinity of Boston, the gas in Roxburg and South Boston had a candle power of about 17½, that in Charlestown and Dorchester about 17, that in Cambridge only 14½, and in East Boston only 14¼ candles. The illuminating power of the gas in the last two places was lower than any other tested; but in regard to the East Boston gas, it is but justice to say that all of the tests were made during a single week. In Cambridge, however, the gas was tested at various times and in different seasons, both alone and in connexion with another expert. At no time should the illuminating power be allowed to fall below about 16 candles, although our law allows it to fall as low as 12 candles. The illuminating power is always within the control of the officers at the works, and can be kept always within the proper limits.

The amount of ammonia was found at the time of our visits to be very large in the Philadelphia gas (52 grains per 100 cubic feet), in the South Boston gas (40 grains), in the Metropolitan, N.Y., gas (25 grains), in Roxburg (19·5 grains), in East Boston (15 grains), and in the Chicago People's (14 grains). In the gas of the other companies there was only a moderate amount; but no gas except the New York Mutual could be said to be free from it. The amount of sulphur was in no case excessive. The illuminating power of the London gas is not allowed to fall below 16 candles, the amount of ammonia is restricted to 2½ grains, and the amount of sulphur to 20 grains in 100 cubic feet, and this sulphur must not be in the form of sulphuretted hydrogen, which can be easily removed by purification. The Massachusetts law does not allow the gas to fall below 12 candles; but this standard is much too low, and should be raised to 16, as is London.

All of the principal works in which water gas is manufactured have also been visited, and all found to yield a gas of good quality. The Harkness process is being used at New London, Connecticut. The essential features of this process are, that anthracite coal is heated to a high temperature in an upright furnace called a generator, and steam is introduced into the top above the coal. This, on passing through the coal, is decomposed, and hydrogen and carbonic oxide, with some carbonic anhydride, are formed. These gases are passed through a hydraulic main and lime-purifier to a small holder. From the holder the carbonic oxide and hydrogen are passed at the rate of 20 cubic feet per minute to one branch of a compound retort, in which they are heated; then to a second branch, where they meet with petroleum gas, the petroleum being introduced into this branch, volatilized and converted into a fixed gas; and finally the mixed petroleum and water gases are passed through the third branch of this retort to a condenser, thence to the meter and holder. The steam is passed through each generator for 20 minutes. The generator is then opened, and 20 minutes more allowed for the coal to rekindle. It is claimed for this process that two generators will give 24,000 cubic feet per day, with the use of 2640 pounds of coal, or 110 pounds of coal will yield 1000 cubic feet of gas. To enrich this 1000 cubic feet there are required about 3¼ gallons of petroleum. Hence the cost of the carbonizing material is—

110 pounds coal, at 7·00 dols. per ton	0·34 dols.
3¼ gallons petroleum, at 12½ cents	0·41 „
Gives for about 1200 feet	0·75 dols.

To this must be added the cost of labour, purifying material, and fuel for the petroleum retort, since that requires an additional fire. The boiler is heated with the waste coal from the generators. As to labour, two men in each watch can take care of six generators, which gives 18,000 cubic feet per day per stoker, which is about the same as in a coal gas-works. The result is not so favourable as this in New London, since there is a demand for only about 15,000 cubic feet per day; and at the present time (Oct. 1, 1876), the process has been discontinued, on account of the present high price of petroleum, and the gas is made entirely from coal.

The Lowe process was in use in Utica, New York, until the works were burned, and is now used at Manayunk, it having been started in the latter place, Aug. 5, 1876. Up to Sept. 21, about 5 million cubic feet of gas had been made, or about 175,000 daily. The peculiar features of this process are that steam is forced up through white-hot anthracite coal, in an upright generator, into the top of which crude petroleum is introduced. The steam is decomposed in passing through the coal, and the petroleum is vaporized and partially decomposed. These mixed gases are then passed through what is called a superheater, or fixer, a chamber similar in appearance to the generator, but filled with fire-brick, which is kept white hot by the heated products of combustion from the generator. Here all of the petroleum is converted into a fixed gas. From the superheater the gases are passed, through a condenser and purifier, to the meter and holder. In this process the runs are 30 minutes, and then an interval of 30 minutes allowed for rekindling the coal, and reheating the fire-brick in the superheater. One evident advantage of this process over the Harkness is, that but one fire is used for decomposing both the steam and petroleum. It is claimed that, with a daily consumption of 200,000 cubic feet per day, each 1000 feet could be made from 50 pounds of coal, and 3 gallons of petroleum, which would cost, with coal at 7 dollars per ton, and petroleum at 12½ cents per gallon, 53 cents. At Manayunk, petroleum has averaged 10 cents per gallon during August and September, 1876. Two men in each watch can manage six sets of apparatus and the boiler, and one man per day is all of the labour required in the purifying-house. Thus five men are all of the labour required to make 750,000 cubic feet per day (the capacity of each set being about 125,000 cubic feet), but on a basis of 200,000 cubic feet, the labour would cost about 10 dols., or 5 cents per 1000 cubic feet. The amount of gas which can be made per stoker is more than 175,000 cubic feet.

The other principal water-gas process is the Gwynne-Harris process, which is in use at Poughkeepsie, N. Y. In this process the anthracite coal is introduced into an ordinary clay retort, which is provided with a false perforated bottom, through which the steam is introduced. The steam is previously superheated by being passed through clay chambers, set in the hottest parts of the bench. In the other retorts of the same bench, common coal gas, cannel coal gas, or petroleum or naphtha gas can be made. At Poughkeepsie, naphtha, costing 8 cents per gallon, is used at the present time. The gases resulting from the decomposition of the steam are passed into the naphtha retort (or bituminous coal retort), and the mixed gases passed through a lime purifier, to remove the carbonic anhydride, and other impurities, and thence through the station-meter to the holder.

This process was subjected to a careful and scientific investigation, during five months in 1869, by Professors Silliman and Würtz, at New Haven, Conn. These gentlemen concluded their report as follows:—

The evidence set forth in this report sustains the following important conclusions, viz.:—

1. The production of illuminating gas by the Gwynne-Harris hydrocarbon process, on a large scale, and from materials in common use, is a result already well established.
2. The apparatus employed for this process is simple, inexpensive, permanent, little liable to derangement, and easily adapted, at a moderate expense, to all existing gas-works.
3. The average yield of gas obtained by this process from ordinary caking coals, with the addition of small per centages (5 to 15) of enriching coal, is 6½ cubic feet per pound, with an average illuminating power of 18 candles, and for a less candle power (say of 15 candles) 7 cubic feet per pound of coal is easily obtained.
4. The gas obtained by this process is remarkably easy of purification, uniform in quality, and very greatly superior to gas obtained by the old process, in its ability to withstand low temperatures, without sensible loss in illuminating power.
5. The cost of making gas by the hydrocarbon process is less than by the ordinary process, very nearly in proportion as the volume of gas obtained is greater.
6. The analytical investigations herein given show that the average composition of the hydrocarbon gas varies much less from that of common street gas than has heretofore been assumed.
7. The heating power of the hydrocarbon gas is found to be greater than that of ordinary illuminating gas, while the water gas is shown to possess a calorific intensity some 70 per cent. greater than that of a good sample of common illuminating gas.
8. The Gwynne-Harris method is peculiarly applicable to the economical use of very rich cannels, or other enriching agents; thus yielding, in a given apparatus, the greatest possible volume of gas, of a given illuminating power, from a minimum weight of materials.
9. The correctness of the theoretical notions, which lie at the foundation of the hydrocarbon process, has long been recognized by the most eminent gas engineers; but it is believed that the solution of this important problem has been first successfully achieved by the American system herein described as the Gwynne-Harris process.
10. In entire variance with popular belief, our analyses prove that a compound hydrocarbon gas consumes much less atmospheric oxygen, and vitiates a given volume of air to a much less degree, than an ordinary gas of equal illuminating power.

The experiments on which the above conclusions were based, were made chiefly with coal as the enricher, not petroleum or naphtha. It is estimated that by this process 1000 cubic feet of gas can be made from 17 lbs. anthracite coal and four gallons of petroleum or naphtha, which gives a cost of 37·3 cents, with coal at 7·00 dols. per ton and petroleum at 12½ cents per gallon, exclusive of fuel, labour, &c.

The advantages claimed for this process are, that gas can be made continuously, not in runs of 20 or 30 minutes, as in the case of the other processes; that it can be used successfully in connexion with the ordinary coal process; and that ordinary coal gas-works can be easily adapted to it. We have heard of no explanation of why the process was given up in New Haven, where the experiments referred to above were tried.

In all of these water gas processes the large outlay and expense of exhausting the gas, necessary in coal gas-works, is dispensed with.

(To be continued.)

THE CHEMICAL COMPOSITION OF PENNSYLVANIA PETROLEUM.

[A Paper read at the Buffalo Meeting of the American Association for the Advancement of Science by S. P. Sadtler, Ph.D., of the University of Pennsylvania, Philadelphia.]

Pennsylvania petroleum has universally been recognized as a mixture of hydrocarbons of varying gravities and boiling-points. A question of great interest to the chemist is, how many of the homologous series of hydrocarbons known to organic chemistry are here represented. This is a matter which has occupied the attention of some of the most careful workers in our science, and they have given much painstaking and conscientious work to its solution.

Pelouze and Cahours were among the first who submitted samples of American petroleum to fractional distillation, and isolated a number of the members of the first or marsh-gas series of hydrocarbons.

C. M. Warren, of Boston, then took up the matter, and gave several years of the most careful study to the subject.. He isolated these members of the paraffin series in a greater state of purity, and determined their boiling-points much more sharply than had been done before. He also considers that he has isolated several members of the next or olefine series of hydrocarbons.

S. F. Pecham, now of the University of Minn., Minneapolis, has given a great deal of attention to Pennsylvania petroleum, studying the products obtained from it by what is termed "cracking;" that is, submitting the oils to a higher heat than is necessary for distillation simply. His work has been mainly, however, with California petroleums, which differ very greatly from those of Pennsylvania.

C. Schorlemmer, of Owen's College, Manchester, England, has probably given the most study to the subject. He has gone so far as to identify not only the normal members of the paraffin series, but isomers which are found to accompany them in the Pennsylvania petroleum.

He has confirmed the presence of members of the olefine series by preparing the dibromides of several of them.

He has also proved the presence of members of the benzol series (or so-called aromatic hydrocarbons) by preparing their nitroderivatives.

A set of some 25 derivatives of Pennsylvania petroleum, including the normal and isomeric members of the paraffin series, the dibromides of members of the olefine series, and a series of nitrobenzols and nitrotoluols, prepared by Professor Schorlemmer, and kindly presented by him to the Chemical Museum of the University of Pennsylvania, was displayed at the Centennial Exhibition, in connexion with material of the Second Geological Survey of the State.

The gaseous exhalations from the petroleum wells have also been examined.

Fouqué, Ronalds, and Lefebvre, have all analyzed these gases, and unite in finding them to consist essentially of the lowest members of the paraffin series, commencing with marsh gas or methan itself.

Professor Henry Würtz analyzed the gas from a well at West Bloomfield, N.Y., which, while made up largely of marsh gas and its homologues, was found to contain some two per cent. of members of the olefine series.

I have also, within the past year, at the instance of the Geological Survey of Pennsylvania, collected and analyzed the gas from four prominent gas wells in the western part of the State. In the case of three of these wells, the gas was either at the time actually being used for fuel in large iron-works, or was about to be utilized in this way. A summary of my results was given in a paper read before the "American Philosophical Society," in Philadelphia, in February last. Suffice it to say, I found the gases chiefly made up of methan with ethan and propan and some free hydrogen and a litttle carbonic dioxide gas. This, I believe, is the substance of our knowledge of the chemical composition of petroleum. Let us consider now if more information can be reasonably looked for as the result of further study.

What was the material used for these investigations? Were the crude petroleums examined by these different authorities exactly the same, or, if by chance they might have been, are they to be compared with all other crude petroleums now known? Those familiar with the crude oils as produced in the different sections of Venango, Clarion and Butler counties, and very recently in Warren and M'Kean counties also, will know that

these oils vary in colour, from a light amber to a dark black, and in gravity from 30° to 55° Baumé—from thick lubricating oils to nearly pure benzine. Moreover, they come from very different strata, or "sand-rocks," as they are termed.

I may be pardoned a short extract from a geological report of Mr. John F. Carll, the assistant geologist of the Survey, in charge of the oil district, which will illustrate this statement:—

"These oil-producing sands form a group of themselves, with well-defined beds of slates and shales—at least 100 feet in thickness—both above and below it; and whether composed of three members, as an oil creek—where they were named first, second, and third sands—or split into five or six members, as they usually are to the south-east and east of the central line of the group, they all lie, as a general rule, within a vertical range of 350 feet.

"Each one of these three sand-rocks, where they lie in clearly-defined beds, furnishes an oil peculiar to itself—the first sand, a heavy lubricating oil of from 30° to 35° gravity; the second sand, an oil of about 40° gravity; and the third, the usual light oil of from 45° to 50° gravity. But, while each sand has its own characteristic production, the oil varies somewhat in colour and gravity in different localities in the same horizon. Thus, the third sand produces a green oil from its lower member, and a black oil from its stray or upper member, where the rocks lie in their normal positions, as on Oil Creek; but, where the stratification varies—thus changing the relations of the several members to each other, both as to thickness and composition—the oil is changed in colour accordingly. At Pleasantville, where the lower member is thicker than the upper, but fine and muddy—and the upper, or stray, is coarse and gravelly, and produces the oil—its colour is nearly black. At Pithole, Cash-Up, and Fagundus, where the lower member has fined down to a thin band of argillaceous flags, and the upper member thickened into a pebbly sandstone, the oil is of a lighter colour. In some parts of Clarion and Butler, where the horizon of the third sand is represented by three or four beds of pebbly sands—sometimes producing oil from one stratum and sometimes from another—the colours shade intermediately between the green and black oils of the upper country. These shades are so gradual and slight that they have not been generally noted, but a critical examination of a number of wells will convince any one of the fact."

It will thus be seen that, if we wish to study the chemical composition of petroleum thoroughly, we have a considerable body of material to choose from. This material must be carefully assorted, too, before any satisfactory study of the petroleum can be made. The great bulk of the crude petroleum that is sent to the refineries, or is exported, is shipped by the pipe-line companies, who have their network of pipes ramifying through whole districts, collecting the entire yield of the neighbourhood, and storing it in their immense tanks. To study such crude petroleums would be like analyzing the sweepings of a mineral cabinet.

The Geological Survey of Pennsylvania has, therefore, proposed to make a more careful chemical investigation of the whole subject.

The material appears at present to be threefold:—

1. The natural gas. This must be considered as of common origin with the petroleum, and, indeed, part of it, being invariably associated with, and always held dissolved in, the crude oils.

2. The crude petroleums themselves. A series of reliable samples of varying physical characters, such as colour and gravity, and more especially from different geological strata, and even different geological horizons, has just been collected. They were taken, in all cases, direct from individual wells. Of lesser importance, yet not to be neglected, are—

3. Certain semi-solid deposits, which accumulate in both gas wells and oil wells, known to the oil men under the general name of "paraffin." A considerable amount of this deposit of buttery consistency has been collected from a large gas well.

The thick material deposited from many crude oils in the bottom of tanks can also be classed in this category.

It is easily perceived that until some study is given to these different materials, it is idle to advance any theories as to the causes of the differences, or as to the origin of the petroleum, apart from general ones based more upon geological than upon chemical grounds. However, as Mr. Carll remarks in his report, "the materials from which the oil is derived must have been sealed up in the measures below ages before, or were then being deposited with the sands themselves, for we can imagine no process by which the oil could be evolved from superior strata, and forced downward into reservoirs below sea-level."

On the first of these suppositions we have founded the theory of Professor Newberry, that the Huron shales underlying all these districts really give rise to the oil and gas by slow processes of distillation. On the second, we must picture to ourselves immense deposits of sea-weeds, supposing the oil-bearing sands to have been deposited by deep-sea currents, or of shallow water vegetable and animal remains, supposing the sands to be beach deposits, as is more probable.

The whole question of origin is a geological rather than a chemical one, and the geologists are the ones to solve it. Still, a careful chemical examination of both the crude oils and the sand-rocks in which they are contained, may contribute something of value to its solution.

It is with this hope that the chemical study of different crude petroleums is about to be begun by the Geological Survey.

Bristol Water-Works Company.—The directors have decided to recommend to the proprietors, at their annual general meeting, to be held on the 31st inst., a dividend on the old and new ordinary shares for the half year ending the 31st of December, 1876, at the rate of 10 per cent. per annum, and payment of 7s. 6d. per share to the proprietors of the £25 ordinary shares on account of arrears of dividend.

Purston Gas Company, Limited.—The annual meeting was held on the 7th inst.—Mr. Wardman in the chair. The directors, in their report, recommended the payment of a dividend at the rate of 5 per cent., and that a balance, equal to 1¼ per cent. upon the capital, be carried to the reserve-fund. The question of an extension of the company's mains to Ackworth led to a conversation, the result of which was favourable to the step, but the decision on the point was left in the hands of the directors.

Reductions in the Price of Gas.—The Corporation of Middlesbrough have agreed to reduce the price 3d. per 1000, and to increase the illuminating power to 16 candles from the 1st proximo. At Chelmsford the directors of the company have decided to reduce the price from 5s. 5d. to 5s. from the same date, subject to the usual discount of 5d. per 1000, making the net charge 4s. 7d. The price of gas at Plymouth will be reduced next quarter by 2d. per 1000 cubic feet—viz., to 2s. 4d. per 1000 cubic feet.

Proposed Purchase of the Stafford Gas-Works.—At the meeting of the Stafford Town Council on the 7th inst., a communication was read from the solicitor to the Stafford Gas Company, stating that the price the company asked for the works and plant was £73,225, besides £4983 6s. 8d., the amount of the bonds chargeable against the stock of the company. The town-clerk was authorized to retain the services of Mr. Bramwell, civil engineer, on the part of the council, and also any other engineer he might deem necessary, and present his report to a future meeting.

GLASGOW WATER SUPPLY.

QUALITY OF THE LOCH KATRINE WATER.

The annual report of Dr. E. J. Mills, F.R.S., has been published. It refers to the 12 months from March, 1876, to February, 1877, inclusive, and is as follows:—

The numbers represent "parts per 100,000;" these can be transformed into "grains per gallon" by multiplying by 7 and dividing by 10.

Mean composition.—The mean composition and mean departure therefrom are as follow:—

	Composition.	Mean Departure.	Mean Departure per Cent.
Total solid impurity	2·75	0·41	15
Organic carbon	0·142	0·020	14
Organic nitrogen	0·021	0·018	86
Ammonia	0·001	0·001	100
Nitric nitrogen	0·002	0·002	100
Total combined nitrogen	0·024	0·019	79
Chlorine	0·74	0·04	5
Hardness (total)	0·46	0·23	50

The figures in the third column show how variable in point of composition is our Loch Katrine supply, as, indeed, must naturally be the case with one in which the amount of total constituents is so extremely small. The individual constituents present certain features of interest, as is shown in the succeeding details.

Total Solid Impurity.—This was at a minimum (2·00) in January, and at a maximum (3·68) in February of this year. In June last its amount was enhanced by the presence of a few particles of iron scale—the only occasion, however, on which that substance was observed.

Organic Carbon.—The variation of the organic carbon very nearly coincides with that of the total solids. Its actual amount is by no means inconsiderable, being about double the proportion actually found in many specimens of unpolluted rain, deep well, and spring waters, though less than half the quantity commonly met with in upland surface waters. Minimum, 0·102, November; maximum, 0·189, December, 1876. It is doubtless chiefly derived from peat. [See *Nitric Nitrogen.*]

Organic Nitrogen.—Having regard to the peaty character of Loch Katrine water, the mean amount of organic nitrogen is low, and extremely satisfactory. In June, August, and December, none was present; the maxima occurred in April, 1876 (0·056), and January, 1877 (0·053). The general ratio of organic carbon to nitrogen is nearly 7 to 1, and calls for no especial remark; but in July, November (1876), and January (1877) it reached the low value of 3 to 1, showing the prevalence at those times of powerful oxidizing influences. The effect in July was probably due to temperature.

Ammonia.—The actual amount is extremely small. In April, July, August, October, and November none was present; the maximum (0·004) occurred in March and September, 1876. Such figures are commonly found in connexion with good waters.

Nitric Nitrogen.—The quantity of nitrogen usually designated as appertaining to nitrates and nitrites presents some noteworthy characters. The mean amount is extremely low. In March, July, August, September (1876), and February (1877) none was present; the maximum (0·009) was found in November (1876). The occurrence of traces of nitrates in a water is satisfactory, inasmuch as it assures us that, among the generally prevailing conditions, the balance has turned in favour of oxidizing influences. And it is actually found that even in November last such influences, then at their climax, were capable of reducing the organic carbon to its lowest amount, the nitrate being at its highest; and nearly as striking an instance is to be found in the water of April last. Such a phenomenon would not be so remarkable in the season of summer. It may, perhaps, be attributed to the chemical action of mist; finely divided water being capable, according to Morin, of producing ozone. I need scarcely add that a low ratio of carbon to nitrogen does not necessarily involve the presence of nitrates.

Total combined Nitrogen.—The mean amount slightly exceeds one-half the quantity encountered in numerous analyses of unpolluted rain water, and constitutes good general evidence of a satisfactory condition. In August, none was present; the maximum (0·063) was found in April (1876).

Chlorine.—The generally prevailing winds in the Loch Katrine district have first traversed the sea. They bring with them a quantity of suspended salt spray, which is, of course, carried down into the loch with the rain. It is natural, therefore, to find chlorine in this water, and to find it in a practically constant proportion. As will have been seen, it is the least variable of all the determined constituents. Minimum, 0·69 in December; maximum, 0·82 in March (1876). Some small fraction, however, of this chlorine must proceed from drainage.

Hardness.—This water is extremely soft, and would be but little surpassed even by distilled water. Minimum, 0·01 in June; maximum, 0·82 in September, 1876.

General Condition.—The general condition of the water has been satisfactory throughout the year. Having regard to the absence of filtration, the enormous volume of the daily supply, and the fluctuations necessarily incidental to a water containing so little of anything in solution, the retrospect is a matter for congratulation. There are only a few points upon which comment seems necessary:—1. The monthly reports contain frequent references to the presence of "vegetable fibres." These are in part due to the residual tow joints of the mains. I am, however, informed that when an old main joint is repaired no tow is at present used, so that this fault is in continual process of amelioration. Perfect freedom from suspended matter can, of course, only be attained by filtration. 2. After a period of heavy rain, and especially of intermittent heavy rain, I have always found the water "ferruginous"—that is, containing dissolved iron. It seems likely that much, if not all, of this iron proceeds from peat. 3. Loch Katrine water has the usual colour of peaty waters. The tint varies much, sometimes from day to day; nor does it admit of any accurate measurement, since peat contains many colouring matters. The colour itself seldom attracts much attention, and is sometimes nearly absent. 4. The discharge of drainage from the hotel at the western extremity of the loch, at a point about two miles from the intake, ought, if possible, to be prevented. The reception of human and animal excreta into a potable water is extremely objectionable, in however small an amount; and, inasmuch as such drainage may at any time become infected, we are bound to regard its presence as a source of danger. 5. The water was at its worst in April, at its best in July. 6. My best thanks are due to Mr. Gale, the officer in charge of the works, for his courteous promptitude in supplying me with information.

Glasgow Water Supply.—Dr. Mills, F.R.S., of the Andersonian University, Glasgow, reports that the water supplied to that city from Loch Katrine last month was of a very pale brown colour, and decidedly ferruginous; it contained suspended vegetable fibres. All samples of Loch Katrine water referred to in the previous reports of Professors Bischof and Mills were drawn from a 3-inch distributing-pipe; but the sample here reported upon was taken from a 13-inch main, whence it is intended to draw all future samples.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

In one or two quarters I hear, at last, of there being some little increase of activity both at the blast furnaces and in the mills. Taken as a whole, however, pig iron remains easy all round for current deliveries on the fulfilment of contracts in the immediate future. Makers, both here and in the surrounding district, however, are very firm in declining to fetter themselves by entering into long-dated engagements at the present prices. Few houses hereabouts are at present engaged beyond the ensuing two months, during which they will doubtless be tolerably well employed.

The most important item of the week in relation to the matters chiefly dealt with by the readers of this JOURNAL is the contract which has been entered into within the past few weeks by the Sheffield Water-Works Company with Messrs. Newton, Chambers, and Co., of the Thorncliffe Iron-Works, for the supply of several miles of pipes. These pipes will be of several sizes, over 12 inches in diameter, and will be laid from the nearest point of the Sheffield Company's mains for the supply of the township of Chapeltown. The order thus deals with several thousand tons of iron, the whole of which Messrs. Newton, Chambers, and Co. are in a position to produce from their own blast furnaces, which smelt their own black-band ironstone mixed with Lincolnshire ore, by means of coal raised in their own mines. I believe I am correct in stating that there were several tenders for the contract; but as the successful firm are very large ratepayers—the largest, in fact, in the township—they doubtless offered more advantageous terms than otherwise would have been the case. I am hardly at liberty to state the exact price at which the order has been placed; but as an indication of the course of the market, I may say that it is between £5 10s. and £6 on the average.

There is no particular alteration to note in respect of the coal trade, except that the firmness of slack, noticed by me last week, continues. On Wednesday last a largely-attended meeting of coalowners was held at Barnsley, for the purpose of considering the coal rates to London, which were stated to operate greatly to the disadvantage of the district. From South Yorkshire to London the present charge over the Great Northern is now 7s. 9d. per ton, having been reduced 6d. per ton on the 12th of March. This was declared to be insufficient, and a deputation was appointed to wait upon the Great Northern directors on the subject.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

Some of the principal firms in the Manchester district are tolerably busy, and in one or two cases are oversold for the present in nearly every class of fuel; but this is a state of things which is exceptional, and there are still general complaints of the slackness of trade, whilst supplies, as a rule, are abundant in the market. In the large coal-producing districts of South-West Lancashire, the pits in most cases are only working from seven to eight days a fortnight, in consequence of the scarcity of orders, and prices, although they are generally maintained, exhibit a want of firmness, so far, at least, as the commoner classes of round coal are concerned. Best coal still moves off only slowly, Arley, at the pit mouth, being quoted at 9s. 6d. to 10s. 6d.; and Pemberton four-feet at 8s. 6d. to 9s. per ton. Although there has been more demand for common coal for house fire purposes, forge qualities continue a drug, and it is difficult to obtain more than 6s. 6d. to 7s. per ton. Common burgy is still very difficult to sell, but the better sorts and slack meet with a very fair inquiry, and the latter description of fuel has a decidedly upward tendency in price. Common burgy, at the pit's mouth, can be bought at from about 4s. 6d. to 5s. per ton; but, for the better sorts, 5s. to 5s. 6d. per ton is asked, and slack is quoted at 3s. 6d. to 4s. 6d. per ton at the pit.

The shipping trade continues in a very depressed condition. Only very small quantities of best coal are being shipped. For good steam coal delivered at the Garston Docks it is difficult to obtain more than about 7s. 6d. per ton; whilst at the High Level, Liverpool, steam coal is being offered at less than 7s. per ton.

In the iron trade there is no improvement to notice. Merchants continue to push outside brands of iron in this district at extremely low prices, and as the local makers are not disposed to follow the continual downward tendency of the market, they are doing little or nothing in the shape of new business. For Lancashire pig iron delivered into the Manchester district 56s. to 57s. per ton for No. 3 foundry, and 54s. 6d. to 55s. 6d. for No. 4 forge, less 2½ per cent., is still being asked; but Middlesbrough iron is being freely offered at 52s. 6d. per ton, foundry, and 51s. per ton for forge numbers delivered here. The finished iron trade is quiet, and to secure orders makers would give way to the extent of about 2s. 6d. per ton upon late rates.

THE COAL AND GENERAL TRADE OF THE NORTH.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the North of England has not improved. It is very dull, and for the first time in a couple of months the shipments of best gas coal from the Tyne Dock show a falling off. There is a very poor demand from the Baltic. Foreign merchants are very much indisposed to enter upon business until affairs in the East have a more settled appearance. The price of best coals is unchanged. It is not likely to vary very much, as nearly all the large gas companies have contracts running over the year. Gas coals have been shipped from the Tyne to Cork and Limerick, and some other Irish ports. The ordinary quantities have been going to London, France, and Hamburg, and small ships have been in request to load cargoes for the lesser Danish and Sound ports. Second-class gas coals do not vary much in the market. From 6s. 6d. to 7s. per ton is their value. Last year a good deal of this class of coal was sent to the Continent upon consignment. It does not seem to have paid the collieries, as less is going this year. Best house coals keep their value in the market. Medium qualities are from 10s. to 11s. per ton; best, of course, are higher than that. The steam coal trade is no better. All the collieries are working short time, and prices are comparatively low. The prospect of an early opening of the Baltic is having no effect upon it.

In the freight market coasting rates are low—4s. 3d. to 4s. 6d. per ton is paid to steamers, and 5s. 6d. per ton to sailing ships, to load coals for London; £8 10s. per keel is the figure paid sailing ships to load gas coal for France, 6s. to the East coast, and from 7s. to 7s. 6d. to the English ports of the British Channel. Some fire-bricks and gas-retorts are being shipped from the Tyne to London and the Continent. A very moderate business is done in coals and goods to the Mediterranean, and freights are low to the Baltic.

The manufacturing iron trade is looking better; water and gas pipes are being got ready for shipment, not only coastwise but abroad. New gas-works are being opened on the Continent. The iron trade, however, recovers very slowly.

HOWDEN GAS COMPANY.—At the annual meeting on the 5th inst., a satisfactory report was presented, the profits enabling the directors to recommend payment of a dividend at the rate of 6 per cent., which was accordingly declared.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At a meeting of the directors of the Coupar-Angus Gas Company, held on Saturday, the 10th inst., it was resolved to erect an additional gas-holder, capable of containing 15,000 cubic feet of gas, at a cost of upwards of £700.

On the evening of Monday, the 12th inst., a meeting of the directors of the Coatbridge Gaslight Company was held, when it was reported by Mr. Mitchell, the manager, that the drainage of the ground, forming the site of the new works at Burnbrae, had been completed in a satisfactory manner. It is confidently expected that these new works will be in operation in time for next winter's gas supply.

The report of Mr. J. Falconer King's examination of the gas supplied to the City of Edinburgh, on the 9th inst., shows that the Edinburgh Company's gas had an illuminating power of 28·51 candles; that of the Leith Company being 27·36 candles. In both cases hydrosulphuric acid was absent, but the presence of ammonia was distinct.

On Friday last the Dundee Gas Bill passed the Committee of the House of Commons without any alteration being made in the clauses.

The question of the Burghs Gas Supply (Scotland) Act, 1876, was under consideration at a meeting of the Police Commissioners of Johnstone, held on Monday, the 12th inst. It was reported by the clerk that no remonstrances had been lodged with him against the action of the Commissioners regarding the adoption of the Act. He was then instructed to apply to the sheriff for registration; after which the Provost stated that a Gas Committee could be appointed to carry out the provisions of the Act. Since then Sheriff Cowan has declared the Act to have become law in the burgh, and has ordered the adoption of the Act to be recorded in the Sheriff Court books at Paisley, the county town for Renfrewshire, that in which Johnstone is also situated. The commissioners of that young burgh are naturally taking some credit to themselves for having been the first to adopt the provisions of Sir Windham Anstruther's Act. The movement which has thus just terminated began by the holding of a special meeting of the commissioners on the 2nd of November last, when the proposal to adopt and apply the Act was unanimously approved of, the question being again considered, and with the same result, at another special meeting, held on the 8th of February.

On Wednesday last, at a meeting of the Police Commissioners of Ayr, Provost Steele called attention to the extent to which the gas accounts, both of the corporation and of private consumers, were increasing, and moved that it be remitted to the Lighting Committee to have a suitable place for testing the gas provided, and that the quality of the gas be tested at least once a week. The proposal was agreed to.

At the last meeting of the Town Council of Paisley, it was reported by the Gas Committee that Messrs. Henderson and Dimmack, coalmasters, Coatbridge, had notified their inability to implement their contract to supply 1000 tons of gas coal, their seam of coal having become exhausted. They were willing to supply another description, a specimen of which had been sent, but, after some conversation, the general opinion seemed to be that it would be better to make a new contract.

The Corporation Water Commissioners of Dunfermline have accepted a tender for the cutting of the pipe track and other works, forming No. 2 Contract, of the Glensherup water supply scheme. There were 17 offers lodged, ranging from £7487 17s. 9d. to £17,512 10s., the lowest being the one accepted.

Works for the supply of water to an elevated suburb of Glasgow—Springburn and Bulgray districts—in which the Loch Katrine supply has hitherto not been available, have just been commenced, at a probable cost of about £13,000, including reservoirs, pumping-engines, &c.

The price of pig iron was very low on Tuesday and Wednesday, but an improvement took place on Thursday, and on Friday there was a strong market, in anticipation of a strike amongst the miners against the reductions of wages that have been announced. A rise of 8d. per ton took place, but ultimately 2d. was lost, and the week closed with the price 2d. higher than on the preceding Friday, and 1s. above the lowest price at which business was done during the week.

Little or no change has taken place in the coal market since last report, the shipping department is duller, but in the local trade an average amount of business is doing. Prices are unaltered, but in several cases lower quotations have been accepted.

BARNSLEY GAS COMPANY.—The annual meeting was held on Monday, the 19th of February—Mr. Inns, chairman. The directors, in their report, congratulated the shareholders that the anticipations they ventured to express on the last occasion—namely, that at the end of 1876 there would be "no inconsiderable balance to carry to the reserve-fund," had been realized. After providing for the maximum rates of dividends on the called-up capital (which had been increased by £4000 during the past year), the sum of £836 9s. 1d. was left as a balance to be carried to the reserve-fund; and the directors had, therefore, no hesitation in recommending the payment of the full statutory dividends. They felt justified, too, in announcing their intention, with a view to paying off the balance owing on the capital account, to make a fourth call on the E shares, payable on the 31st of March inst., and a fifth and final call, payable on the 30th of June next. And, if the current year should prove as satisfactory as the past, they proposed to consider whether a reduction in the price of gas in the borough might not, and indeed ought not to, be made. The directors had to report the works to be in a thorough and efficient state of repair. They reminded the shareholders, however, that, having regard to past experience, a large sum for repairs and renewals would probably have to be expended year, by year by reason of the frequent disturbances from mining operations to the ground in which the mains and pipes were laid, and the consequent injury such mains and pipes sustained. Not only was considerable expense incurred in relaying them, but serious loss arose in the large waste of gas by leakages; and from these causes considerable delay must ensue before the reserve-fund could be raised to the maximum amount of one-tenth of the nominal capital. The report concluded by alluding to the vacancies which had arisen at the board, and expressing the deep regret of the directors that two of those vacancies had arisen through the deaths of old and valued colleagues.

Revenue Account, for the Year ending Dec. 31, 1876.

Dr.		*Cr.*	
Gas	£15,308 11 9	Coal, 9876 tons	£4,940 7 6
Meters	925 13 0	Lime, 633 tons	380 0 0
Coke	1,646 3 2	Salaries, viz.—	
Tar and lime	951 18 5	Secretary & manager, assistant-manager, auditors, solicitor, and office clerks	821 18 4
Ammoniacal liquor	535 8 3	Wages	3,484 8 8
Sundries	144 19 3	Rates and taxes	624 0 5
Carriage of coke	81 2 11	Repairs and renewals	1,182 15 6
Premium on E shares sold	127 15 0	Law charges	0 18 10
Bad debts recovered	5 4 4	Carriage of coke	86 14 10
		Commission and interest	228 13 11
		Interest on loans	343 1 0
		Directors allowance	100 0 0
		Discounts, abatements, & bad debts	593 6 4
		Net profit, carried to divd. account	6,940 10 3
	£19,726 16 1		£19,726 16 1

Meltham Gas Company, Limited.—The annual meeting was held on the 5th inst.—Mr. R. Mellor in the chair—when a dividend of 5 per cent. was declared, and a balance of profit, amounting to £180, carried forward.

Belper Gas Company.—The half-yearly meeting was held on the 27th ult., when the usual dividend of 5 per cent. for the half year was declared.

Hunstanton Gas Company.—The half-yearly meeting was held on the 22nd ult., and a dividend at the rate of 3 per cent. per annum was declared.

Birmingham Water Supply.—Dr. Hill, the Medical Officer of Health for Birmingham, reports that the water supplied to that town during February was clear and yellowish, and of a little better quality than the previous month.

Quality of the Dumfries Gas.—Mr. A. Malam reports that the illuminating power of gas, as tested on the works, for the week ending the 16th of March was as follows:—

March 10	27·61	candles.
„ 11	27·14	„
„ 12	27·61	„
„ 13	28·00	„
„ 14	28·57	„
„ 15	28·57	„
„ 16	27·61	„

Average illuminating power, 27·87 candles.

Extinguishing a Public Lamp.—An Expensive Freak.—At the Hull Police Court, on the 10th inst., a young man, named T. W. Robinson, was charged with being drunk, and also with extinguishing a public gas-lamp in Savile Street. A police-constable deposed to seeing the prisoner climb a lamp-post and put out the light. Mr. Gorwood, on behalf of the British Gas Company, stated that the offence was one of very frequent occurrence in Hull, and it was very rarely the offenders could be discovered. Wherever burglaries had been committed of late, it was found that the public lamps in the locality had been put ont. The magistrate fined the prisoner £5 on the second charge, stating that he intended the case to be a warning to others who might commit such objectionable acts.

Hull Gas Supply.—Mr. James Baynes reports that the gas sent into the Sculcoates and Myton district, during February, by the British Gas Company gave the following results, free ammonia and sulphuretted hydrogen being at no time present to the ordinary test:—

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16·60	15·80	16·03
Grains of sulphur per 100 feet	31·00	28·70	29·90

Mean barometer and temperature in experiment-room: Bar.,29·90; temp.,53°.
In the east district, Mr. James Baynes, jun., reports as follows:—

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16·23	15·85	16·04
Grains of sulphur per 100 cubic feet	—	—	9·15
Grains of ammonia per 100 cubic feet	—	—	7·43

Mean barometer and temperature in experiment-room: Bar., 29·47; temp., 55·5°.

New Gas-Works at Muirkirk.—With the view of providing an improved supply of gas for their works, offices, workmen's houses, &c., at Muirkirk, Ayrshire, the Eglinton Iron Company have recently completed the erection of new and very substantial gas-works, which are capable of producing and delivering about 20,000 cubic feet of gas per day. The various parts of the works occupy the four sides of a square. On the back line there is a capacious retort-house, which is also intended for the storeage of coal. It measures 30 feet by 26 feet inside, the height of the side walls being 14 feet; and it is covered by a substantial slated iron roof. In the rear of the retort-house a shoot has been constructed for receiving the coals from an adjoining railway, which lies at a considerable elevation above the level of the works. The retort-house contains five retorts in three ovens, arranged so as to suit the requirements of the different seasons of the year. Adjoining the retort-house there are the chimney, which is 30 feet in height, and the condensers. Then there is a suitable house in which are placed two 6-feet by 4-feet purifiers, with travelling gear complete; and, connected with the purifier-house, there is a capacious lime store. The buildings forming the front line of the works include the manager's dwelling and office (separated from each other by the gateway to the works), and the meter and governor house. The gasholder is 35 feet in height by 12 feet in diameter. It works in a cast-iron tank, and is guided by four cast-iron columns, braced together at the top by means of four ornamental lattice girders. The whole of the connecting-pipes are of 6 inches bore. Messrs. Laidlaw, Sons, and Caine, Barrowfield Iron-Works, Glasgow, supplied the street-mains, and all the rest of the iron-work, with the exception of the governor, which is one of the patent forms devised and manufactured by Messrs. D. Bruce Peebles and Co., Edinburgh. Its working and bye-pass valves are furnished with ornamental standards and hand-wheels. The entire works present an unique and substantial appearance, and were constructed from plans prepared by Mr. George R. Hislop, manager of the Corporation Gas-Works, Paisley. The total cost of the works will be upwards of £2000.

Composition of Petroleum and the Proper Standard of Safety.—At the monthly meeting of the Chemical Section of the New York Academy of Sciences on the 12th ult., Professor Chandler, Ph.D., read a paper on this subject. He stated that, although petroleum had been known for centuries, it had only recently come into general use for illumination, for the reason that suitable lamps had been wanting. Lamp chimneys were invented about the beginning of the present century, previous to which time there had been only smoky lamps, such as are found at Pompeii. The inventor of lamp chimneys had done a great deal for civilization, by making it possible to read at night. In 1856 the manufacture of oil from Boghead coal was begun, and in a short time coal oil, or kerosene, had come into extensive use. Lamps had been devised for burning this coal oil, and proved suitable for burning petroleum. A company was organized to collect the petroleum, which was soaked up by blankets from the surface of pools of water. The speaker then described the boring of the first well by Colonel Drake, the subsequent excitement, the quantity of oil produced, and other incidents connected with it. The oil, he said, usually comes from Devonian rocks, which are much older than the carboniferous or coal measures. Petroleum contains about 85 per cent. of carbon to 15 per cent. of hydrogen. It consists of a series of hydrocarbons of the simplest kind, known as the marsh gas or paraffin series, CH_4, C_2H_6, &c., or of the general formula, $C\ H_{2n+2}$. The oils of Italy do not contain any of the lighter oils, which have already evaporated. In Pennsylvania the rocks are impervious, and evaporation is consequently impossible. In California, where the oil is more plentiful on the surface, there is but little beneath, as it has all run away or evaporated. There is another series of hydrocarbons called olefines, of the general formula $Cn\ H_2n$, but these do not occur to any considerable extent in American petroleum. They are distinguished from the paraffin or marsh gas series by the fact that they are attacked by sulphuric acid and converted into alcohol, so that the manufacture of alcohol from illuminating gas is a possibility. Alcohol was exhibited at the Paris Exhibition, made in that way. There is some doubt at present whether the white solid which we call paraffin belongs to the paraffin or the olefine series; probably there are some of each series. There is another series of hydrocarbons known as the aromatic series, benzol C_6H_6, &c., which is found in Rangoon tar, but not in our petroleum. When benzol is treated with nitric acid, it is converted into artificial oil of bitter almonds. Dr. Chandler thought he had noticed this odour in treating petroleum with nitric acid. After a digression on artificial alizarine, the speaker described the method of refining petroleum by fractional distillation, the destruction of colouring matter and gummy substances by sulphuric acid, and washing with soda, to remove traces of the acid. Slugge acid is the name given to the acid after it has been in contact with the oil, and it is from this acid that we derive the foul odours wafted to this city from Long Island City by every easterly breeze. This acid is used in the manufacture of fertilizers. In regard to testing safe and dangerous oil, Dr. Chandler showed some interesting experiments. Some oil was placed in an open tester, and gradually heated on a water-bath with a thermometer. It was found to flash, or give off combustible vapours, at 110° Fahr., and it burned at 118°, being what is called very safe oil. He then placed some of this same oil in a closed vessel resembling a metal lamp, but provided with a cork instead of the common head or burner, and having electric wires attached. On heating the oil to 85°, and sending a spark through the vapours, an explosion took place which blew out the cork with a loud report, showing that oil, which has been considered safe, gives out explosive vapour at ordinary summer heat.—*Scientific American.*

Recent Studies of Luminous Flames.—For a long time Sir Humphrey Davy's explanation of the luminosity of flames—that it was due to the presence of highly-heated solid particles—sufficed for all observed phenomena. A serious blow to its sufficiency was given, however, when Frankland discovered that certain flames were luminous under conditions which left no reason for supposing that solid matter could be present. For instance, hydrogen and carbon-monoxide, burned in oxygen under a pressure of 10 to 20 atmospheres, yield a luminous flame giving a continuous spectrum. So likewise the non-luminous flame of alcohol becomes bright when the pressure is increased to 18 or 20 atmospheres. Frankland inferred, from experiments like these, that the luminosity of flames was due rather to the presence of the vapours of heavy hydrocarbons, which radiate white light, than to incandescent solid matter. Still further doubt of the prevalent theory was raised by the experiments of Knapp, which proved that the diminished luminosity of a flame on the admission of air could not be due, as had been supposed, to an oxidation of the carbon suspended in the luminous gas, since the same effect was produced when nitrogen or carbon-dioxide, or other indifferent gas, was used as a diluent. Stein and Blochmann attributed this effect to the direct influence of the diluting gases in separating the particles of carbon, so that the oxygen of the air might unite with them more quickly than under the ordinary circumstances of combustion. Wibel held, on the contrary, that the diminished luminosity was due entirely to the absorption of heat by the diluting gas, and supported his view by some very ingenious experiments. The correctness of this conclusion has been, in turn, controverted by the later experiments of Stein and Heumann, particularly the latter, which seem to show that the diminished luminosity consequent upon dilution is due not solely to dilution nor wholly to the cooling action of the added gases, but to both these causes acting together, and frequently supplemented by a third cause—namely, the energetic destruction of the luminous material by oxidation. Heumann's experiments, which have been particularly ingenious and careful, lead to the following results:—That hydrocarbon flames, which have lost their luminosity by the withdrawal of heat, become luminous again by the addition of heat; that flames rendered non-luminous, by dilution with air or indifferent gases, become luminous again on raising their temperature; that flames rendered non-luminous by excess of oxygen, which brings about energetic oxidation of the carbon, are rendered luminous again by diluting the oxygen with indifferent gases. In most cases of diminished luminosity, two or all of these causes are at work. Another unsettled question with regard to flames has been the cause of the non-luminous space between the opening of a gas-burner and the flame, or between the wick of a candle and the luminous envelope. Blochmann attributed it to the inability of the surrounding air to mix at once with the stream of gas so as to make it combustible. Benevines, on the other hand, thought the dark space due to the mechanical action of the issuing gas, whereby the air is driven to a distance from the orifice of the burner—greater or less, according to the pressure on the gas, leaving a space wherein the gas is deprived of the requisite amount of oxygen, and consequently remains unburned. Both these explanations are shown to be insufficient by the single circumstance that a flame never directly touches any cold body held within it. In all such cases Heumann finds an explanation of observed conditions in the cooling effect of its surroundings—burner, wick, cold iron, or what not—upon the gas. For a certain space around the cooling body the gas remains at a temperature too low for ignition. Where the gas issues under high pressure, or is greatly diluted, the distance of the flame is attributed partly to this same cooling action of its surroundings, but more especially to the fact that the velocity of the stream of gas in the neighbourhood of the burner is greater than the velocity of the propagation of ignition within the gas.—*Scientific American.*

Register of New Patents.

1205.—Garside, C., Glossop, "*Improvements in rotatory engines, applicable also to exhausting, forcing or raising, and measuring fluids.*" Patent dated March 21, 1876.

The principle of this invention consists in causing the steam to press against vanes or pistons on the periphery of a flanged pulley, revolving within a cylinder, which is fixed. A block fixed to the cylinder, and fitting steam-tight in the periphery of the pulley, confines the steam, so that it must act on the pistons and force the wheel round. The space between the periphery of the pulley and the cylinder is rendered steam-tight by means of ordinary rings; the pistons and block also are rendered steam-tight by means of plates pressed to their seats by springs. For measuring fluids the machine at every revolution will discharge a quantity equal to the capacity of the space in the periphery of the wheel, less the quantity displaced by the two piston plates. This will be the case whether the machine is propelled by the fluid or made to force the fluid.

1223.—Porter, G., Cullum Street, London, "*Improvements in glass, opal, and other shades and reflectors, and method of supporting and affixing them on to gas and oil burners.*" Patent dated March 22, 1876.

This invention consists in forming a shade or reflector in one or more pieces, the lower portion having a foot, so as to be affixed to the burner by means of set screws, clips, rings, or other fastening, or it may simply rest upon the burner. When made in more than one piece, the outer edge of the lower portion or screen has either a plain edge or turned-up flange, so that the upper portion or reflector may seat into or rest upon it. The outer edge of the upper portion or reflector has either a plain edge or turned-down flange, so as to rest upon or seat into the lower portion or screen, thus forming a complete shade and reflector.

1230.—M'Jannet, J., Greenock, "*A new or improved ball-cock.*" Patent dated March 22, 1876.

This invention consists of a vertical branch, by which the water is led from the supply-pipe to the cistern or other vessel to be supplied. The lower part of this branch terminates inside a hollow casing, having a discharge orifice at its lower end or side. Beneath the end of the vertical branch, and extending through the casing, is a shaft, and to the portions of it projecting outside the casing the lever with the ball at the end is attached, so that as the ball rises or falls according to the level of the water in the cistern, the shaft is moved round on its axis through an angle corresponding to the motions of the ball, and a valve being carried on the shaft, it is raised against or lowered from the orifice of the branch within the casing, so that the supply of water is either cut off or thereby regulated in quantity.

1232.—Wilson, E., Exeter, "*Improvements relating to pump and other valves, and to the securing of the same and parts connected therewith in their chambers or boxes.*" Provisional protection only obtained. Dated March 22, 1876.

According to this invention, in the valve chamber or box is provided a cylinder or cylinders with two or more valves in each cylinder properly arranged in relation to the suction and delivery apertures. The flange of the valve at one end of the cylinder rests on the outside of a flange or rim on a seating fitted therein, and the lips of the valve extend inward. At the other end of the cylinder the flange of the valve rests upon the inside surface of a flange or rim on the cylinder.

On the flange of the first-named valve there is placed a metal ring, which has a cross-bar at the back, and outside or over it is a cross stay formed or secured inside the valve-chamber. Through this stay passes a hand screw, the inner end or point of which bears against the cross-bar of the metal ring, so that by turning it the ring will be compressed upon the flange of the valve, and will bind and secure the same firmly on its seating. The latter rests on a cylindrical distance piece, which bears against the flange of the other valve, and by means of this distance piece the pressure of the screw is transmitted to the latter valve, and makes the same fast on the flange or rim.

The first or upper valves in the above arrangement are the suction valves, and the second or lower valves are the discharge or delivery valves. The ports leading to the cylinder ends are between the valves.

1246.—Williams, R. H., St. Austell, Cornwell, "*Improvements in apparatus for preventing explosion and spontaneous combustion in coal on board ship.*" Provisional protection only obtained. Dated March 23, 1876.

For the purpose of carrying out these improvements, to prevent either the explosion of the gases evolved or the spontaneous combustion of the coal itself in ships, there is provided a series of tubes, pipes, or cylinders, of cast or wrought iron or other metal, and of various lengths and diameters, the internal diameter of one pipe exceeding the external diameter of the other. These are placed alternately, a large pipe first, then a small one, and so on throughout the length, depth, and width of the cargo of coals, each large pipe being entered a few or more inches by the smaller one, as necessity requires.

The pipes are placed by hand in the cargo as it is being put on board the ship, and by the arrangement of large and small can be easily added to and lengthened. The large pipe being of larger diameter internally than the small one externally, will allow almost any amount of flexibility of the whole length. The pipes are carried through the cargo as taken on board the ship, from end to end, either in her main hold, bunker, store, or other compartment used for conveying coals on board ships.

These tubes or pipes should be put in when 6 feet of coal is in the hold of the vessel from forward to abaft and bulkheads, and for each 6 feet of coal in height after the first 6 feet; thus 12 feet requiring one run only, 18 feet requiring two runs in height. If the ship is very large and of great beam, there is placed laterally a run of pipes or tubes every 6 feet, as for a hold 12 feet wide one run of tubes, for 18 feet wide two runs, and so on for increase of width. These tubes are closely perforated all over their entire length, and where fitted into each other a considerable annular space will allow ingress of vapours or gas. Close to and secured at the bulkheads at each end of the vessel's hold, bunker, or other coal compartments, are perpendicular pipes or other contrivances going up through the deck, and terminating (in steamboats) either in the funnel or under the furnaces, or over the deck in funnel-shaped escape ways or other outlets. These perpendicular pipes are so constructed that connexions may be most easily effected by the trimmers of the coals with the perforated tubes or pipes running through the cargo.

1256.—Lake, W. R., Southampton Buildings, London "*Improved combustible compounds and apparatus for the production of gas for domestic, manufacturing, military, and other purposes.*" A communication. Patent dated March 24, 1876.

The object of this invention is to utilize gaseous substances which ignite spontaneously when brought into contact with air, such, for example, as arsendimethyl, phosphoretted and siliciuretted hydrogen, sodium, ethyl. These substances are employed for purposes of lighting with flame, for the priming of guns and of projectiles used in warfare, for giving light and for heating, and may be used either alone or mixed with other combustible gases which possess the same properties of compressibility or liquefaction and vaporization or expansion, and to which they communicate the property of igniting spontaneously. The liquefaction by pressure or by reducing the temperature may be effected either before or after the mixing. The mixing may also be effected with liquid carburet of hydrogen evaporating at low temperatures.

According to this invention gases which ignite spontaneously by contact with the air are produced by the ordinary means known to chemists, and are collected in gasometers and the like, or they may be mixed with other known combustible gases, such, for example, as methylin. The gas alone, or the mixture, is compressed and liquefied by means of pumps, and in suitable receptacles. From these receptacles the liquid flows into a small portable apparatus, from which it can, at the will of the person using it, vaporize, and be allowed to escape, to ignite on coming in contact with the air.

1264.—Lawrence, P., Blackfriars Road, London, "*Improvements in gas and other stoves.*" Patent dated March 24, 1876.

This invention relates to improvements in the arrangement and construction of gas and other stoves, whereby the heat generated by the combustion of gas, oil, spirit, fuel, or other heat-generating means in the combustion chamber is caused to circulate in a series of chambers, so as to absorb and transmit the heat to the room or chamber in which the stove is situated, the combustion chamber being so arranged as to apply the heat generated therein for cooking and other purposes if required.

For this purpose, above the combustion chamber an oven is arranged if required, but if the stove is simply required for warming and ventilating purposes only, then the oven may be dispensed with. Over the outlet from the oven or from the combustion chamber, as the case may be, a cover or cap of cylindrical or other suitable form is placed, which receives the heat from the chamber below, and over this cap or cover a series of two or more other caps or covers are placed or arranged, a comparatively narrow space being left between each of them, so that the heat can circulate between them by passing through suitable inlet and outlet passages formed through them, the heat and products of combustion finally escaping by an outlet in the top of the outer cap or cover into the room or chamber to be heated, or by a pipe or flue into a chimney if desired.

APPLICATIONS FOR LETTERS PATENT.

835.—Alsing, G., Bradford, York, "Improvements in the treatment of sewage and other polluted waters and their deposits, and apparatus therefor." March 2, 1877.

840.—Wirth, F., Frankfort-on-the-Maine, Germany, "A new filling for gas-meters." A communication. March 2, 1877.

842.—Trull, C. K., New York, U.S.A., "An improved apparatus for lighting gas." March 2, 1877.

843.—Hamilton, W., Glasgow, "Improvements in combined steam-engines and pumps." March 2, 1877.

857.—Barker, E. D., Bedford Row, and Harris, A. G. R., Dorset Square, London, "Improvements in ball-valves and other draw-off valves." March 3, 1877.

860.—Hanson, J., Dewsbury, York, "Improvements in treating sewage and other foul water, and in softening clarified water for re-use." March 3, 1877.

922.—Brothers, W., Blackburn, Lancs, "New or improved apparatus to be used in the manufacture of clay pipes, gas, and other retorts, and other articles made of clay." March 7, 1877.

952.—Hallsworth, S., and Bailes, R., Leeds, "Improvements in the means or method of treating and clarifying sewage or other impure waters." March 9, 1877.

959.—Hardisty, G. E., Nottingham, "Improvements in cocks and taps." March 9, 1877.

965.—Fox, W. P., Sheffield, "An improvement in spanners or wrenches." March 10, 1877.

966.—Sillar, W. C., Blackheath, Kent, "Improvements in and in apparatus for separating the fluid from the solid portions of sewage sludge, peat, and other matters." March 10, 1877.

995.—Caldwell, A., Strathbungo, N.B., "Improvements in apparatus for measuring and controlling or regulating the flow or supply of water." March 13, 1877.

997.—Brémond, L., Versailles, France, "Improvements in means to be employed for preventing the deposit of naphthaline in gas apparatus, mains, and fittings." March 13, 1877.

1009.—Moysey, J., London Street, London, "Improvements in pumps." March 13, 1877.

1033.—Livesey, J., Westminster, London, "Improvements in filters for water and air." March 15, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

3949.—Brook, E., and Wilson, A., Middlesbrough-on-Tees, York, "Improvements in apparatus for making gas." Oct. 12, 1876.

4087.—King, J. T., Liverpool, Lancs, "Improvements in chandeliers, brackets, and bracket arms, and in apparatus employed in the manufacture of the same." A communication. Oct. 23, 1876.

4424.—Hellyer, S. S., Strand, London, "Improvements in receptacles for house sewage or waste, and in the means for trapping the same." Nov. 15, 1876.

4788.—Andrews, W., Lisbon, U.S.A., "Improvements in water-gauges or stop-valves." Dec. 11, 1876.

4848.—Rydill, G., Highgate, London, "Improvements in treating sewage, extracting filtration, preparing disinfectants and manure." Dec. 15, 1876.

4935.—Jennings, G., Lambeth, London, "Improvements in water-closets and latrines, and in valves for regulating the supply and discharge of water, and preventing percussion in water-pipes." Dec. 21, 1876.

5006.—Heck, J. H., Perry's Close, London, "Improvements in direct-acting steam-pumps." Dec. 27, 1876.

97.—Collinge, T. A., and Paterson, T. O., Rochdale, Lancs, "Improvements in the production of material for and method of purifying coal gas, and in apparatus used for that purpose." Jan. 9, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

653.—Scott, H. Y. D., "Improvements in the treatment of sewage and in the manufacture of manures therefrom." Feb. 20, 1874.

679.—Lake, W. R., "Improvements in air-tight joints for gas-retorts." Feb. 23, 1874.

702.—Weston, J. H., "Improved means of and apparatus for purifying, carburetting, and increasing the illuminating power of coal gas." Feb. 24, 1874.

717.—Robinson, A. H., "Improvements in meters for measuring water and other liquids, and in motive-power engines, parts of such improvements being also applicable to flushing water-closets and preventing waste of water." Feb. 25, 1874.

733.—Somerville, J., "Improvements in the method of manufacturing gas for lighting and heating, and for the apparatus used therein." Feb. 27, 1874.

766.—Beck, W. H., "Improvements in the manufacture of illuminating gas, and in apparatus employed therein." March 2, 1874.

800.—Forbes, Rev. G. H., "A new or improved compound for use as fuel, or for the manufacture of gas for heating and illuminating purposes, capable also of being used in the production of a material suitable for the purification of gas." March 4, 1874.

810.—Weston, J. H., "Improved means and apparatus for increasing the illuminating power of gas in lamps, and other mediums of lighting, portable, and otherwise." March 5, 1874.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

315.—Johnson, J. H., "Improvements in gas and other pressure regulators." Feb. 3, 1870.

364.—Wigner, G. W., "Improvements in the mode of and apparatus for treating and purifying sewage." Feb. 8, 1870.

463.—Leoni, S., "Improvements in apparatus for cooking, heating, and lighting by gas." Feb. 17, 1870.

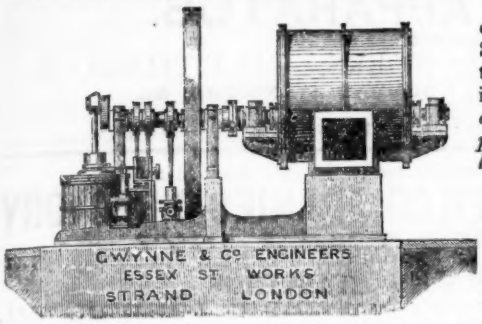
506.—Leopard, J., "Improvements in treating and filtering sewage, and in apparatus to be employed for these purposes." Feb. 21, 1870.

565.—Holden, J. J., "Improvements in apparatus for charging and discharging gas-retorts, and for other similar purposes." Feb. 25, 1870.

713.—Lundy, J. J., "Improvements in effecting the decolorization, deodorization, and purification of foul and waste waters and sewage, and of supernatant sewage water." March 10, 1870.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS;
Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

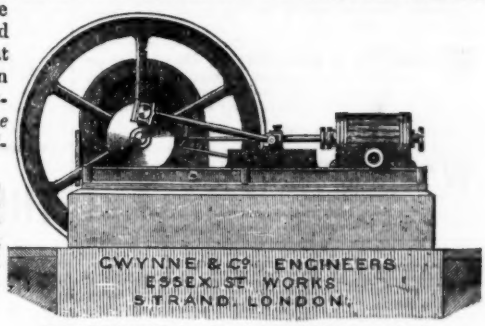
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



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GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure. Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO.**, Hydraulic and Gas Engineers,
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

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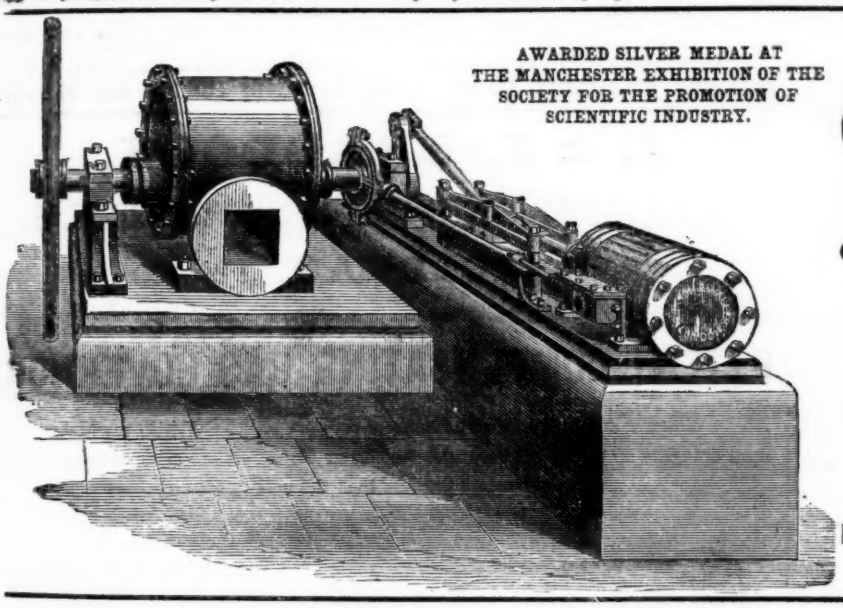

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TAR, LIQUOR, and other PUMPS,
SCRUBBERS and PURIFIERS,
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MANUFACTURERS OF **WET AND DRY GAS-METERS;**
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FOR STATIONS, DISTRICTS, DWELLING-HOUSES, AND PUBLIC LAMPS,
OF WHICH UPWARDS OF 90,000 ARE NOW IN SUCCESSFUL USE.
"These Lamp-Governors are so superior that they are likely to supplant all others."—*Dr. Wm. Wallace, F.R.S.E., F.C.S.*

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COAL GAS.

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CONSISTING OF
Tables, Rules, and Useful Information for Gas Engineers, Managers,
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WANTED, a first-class Gas-Fitter, well used to every branch of the trade. Constant employment. Must be steady.
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WANTED, in the country, a Tester, to test both wet and dry meters in tin and iron cases, and who can assist in putting meters together. State experience and wages required.
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WANTED, at the Reading Gas-Works, a steady and experienced METER REPAIRER. Used to both Wet and Dry Meters. The situation is a permanent one.
Apply, stating age, experience, and wages required, to Mr. E. BAKER, Engineer.

TAMWORTH GAS COMPANY.

WANTED, a Working Manager. He must thoroughly understand the manufacture, distribution, and testing of gas; also laying mains and services, taking indexes of meters, and retort-setting. Salary £90 per annum, with house, coal, and gas free.
Address, with testimonials, on or before the 25th day of March, 1877, to the SECRETARY, Tamworth Gas Company.

FOR SALE, a Second-hand Gasholder, 33 ft. diameter and 9 ft. deep. Is in very good condition, and will be sold cheap.
Apply to Mr. W. T. HEWS, Gas-Works, HENLEY-ON-THAMES.

READING GAS COMPANY.

FOR SALE, as they now stand, and at any reasonable price, as the ground upon which they stand is wanted, four 12-ft. square Cast-Iron PURIFIERS, with centre-valve and connexions, grids, tee bars, &c., complete.
Apply to Mr. E. BAKER, Engineer, Gas-Works, READING

TO BE SOLD, Four Cast-Iron Purifiers, 6 ft. square, with hydraulic centre-valve; also Ten 18-in. round, and Sixty-two 15-in. round Retort Mouthpieces, and Forty-seven 6-in. H-Pipes.
Apply to W. WINSTANLEY, Manager, Gas-Works, NEWCASTLE-UNDER-LYME.

WALTON-ON-THAMES AND WEYBRIDGE GAS COMPANY.

FOR SALE, Three Engines and Ex-hausters (Two by Gwynne, and one by Waller) for 15,000 feet per hour. Being about to be replaced by larger ones.
Can be seen at the Works, Walton-on-Thames, or particulars can be had of Mr. GEORGE ANDERSON, 35A, Great George Street, WESTMINSTER.

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FOR SALE, Two Telescopic Gasholders. One 60 ft. by 16 ft., the other 70 ft. by 18 ft., each complete, with cast-iron tanks, columns, girders, and inlet and outlet pipes, valves, &c., both of modern construction, in good condition, and made by Messrs. Piggott and Co., of Birmingham. To be seen at work at the Gas-Works, Birkenhead. Cause of removal to make room for extensions.
To be sold a bargain, taken down and re-erected ready for work.
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THE Swansea Gaslight Company have for immediate SALE, the following Plant:—
A 6-h.p. Patent Trunk Engine. (Beale.)
Exhauster to pass 15,000 feet per hour. (Beale.)
An 8-h.p. Grasshopper Engine. (Easton and Amos.)
Exhauster, 20,000 ft. per hour. (Beale.)
Tar, Liquor, and Water Pumps, Eccentrics, Shafting, and Driving Pulleys.
Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.
A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.
May be seen at the Gas-Works, Swansea. The whole in perfect working order; replaced by plant of larger dimensions.
Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

TO GASHOLDER MAKERS.

THE Directors of the Market Har-borough Gas Company are prepared to receive TENDERS for a Single-Lift GASHOLDER, 60 ft. in diameter and 18 ft. deep.
Plans and specifications may be seen at the Works of the Company, at Market Harborough, or on application to Mr. John Eunson, C.E., Northampton.
Tenders addressed to the Secretary, endorsed "Tender for Gasholder," to be delivered on or before the 31st of March. By order,
JOHN LESTER, Secretary.
Market Harborough, March 2, 1877.

J. EDMUNDSON & CO.,
19, GREAT GEORGE STREET, WESTMINSTER,
LONDON, S.W.,
MANUFACTURERS OF EVERY DESCRIPTION OF
GAS APPARATUS.
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Estimates given free of Charge.

Now Publishing, will be ready the first week in April,
THE GAS & WATER COMPANIES DIRECTORY
FOR THE YEAR 1877,
EDITED BY
CHARLES W. HASTINGS,
8, BUCKINGHAM STREET, ADELPHI, LONDON, W.C.,
CONTAINS

An Alphabetical List of Towns in England having Gas or Water Companies.
Date of Formation of the Company.
If Incorporated under Special Act of Parliament, and the date of such Act or Acts.
If under any of the Limited Liability Acts.
Amount of Share Capital.
Name of Chairman.
Name of Engineer or Manager.
Name of Secretary.
If Let on Lease, Name of Lessee.
If a Private Venture, Name of Owner.
If Purchased by the Corporation (and in cases where possible the date of such Purchase), or if the Property of the Local Authorities.
Population of all Towns.
Railway Communication, and the Distance from London.
Special Notice is taken of all the Members of the "British Association of Gas Managers."

THIS WORK IS UNDER THE PATRONAGE OF ALL THE LEADING GAS & WATER ENGINEERS AND SECRETARIES OF THE METROPOLITAN & PROVINCIAL COMPANIES.

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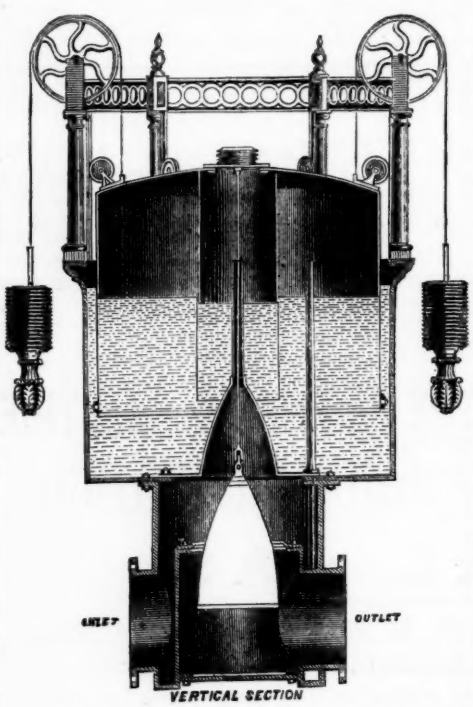
GLOBE METER-WORKS,
OLDHAM,
Beg to submit to Gas Engineers their
PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

CATHELS'S PATENT GAS-WASHER

Is an excellent cleanser of gas from tar, ammonia, sulphur, and carbonic acid, reducing the cost of subsequent purification 30 to 50 per cent. Needs no motive power or attention beyond drawing off and recharging as required. Has no moving parts or complications to get out of order. Is of moderate cost, and is practically indestructible.

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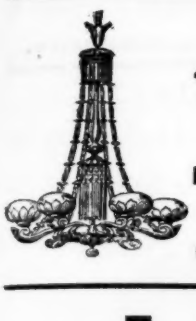

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And all descriptions of FIRE-BRICKS.

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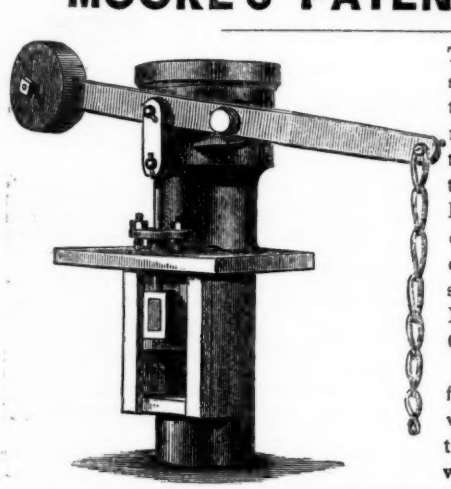
A LARGE QUANTITY OF RETORTS ALWAYS IN STOCK.

Circular .	14 in.,	15 in.,	16 in.,	18 in.
Ovals . .	17 in. × 14 in.,	17 in. × 15 in.,	20 in. × 15 in.,	21 in. × 15 in., &c.
D's. . .	14 in. × 14 in.,	15 in. × 12 in.,	15 in. × 13 in.,	17 in. × 14 in., 18 in. × 13 in.
	18 in. × 15 in.,	20 in. × 16 in.,	22 in. × 14 in.,	24 in. × 14 in., 24 in. × 15 in., &c.

Special attention given to the execution of Export Orders.

MOORE'S PATENT DIP-PIPE.



THE advantages of this Dip will be seen from the engraving. It is thoroughly effectual in its working, removing the whole of the pressure of the hydraulic main from the retort, thus causing a great saving in gas. It is very easy of manipulation, requiring little care and attention; it cannot get out of order, and, when shut, works as an ordinary Dip-Pipe. No accumulation of carbon in retort. Can be fixed to existing H-pipes.

In ordering the Dip, the distance from top side of hydraulic main to water-level should be stated; also the Dip at which it is required to work when the valve is shut.

PRICES—3-in., 35s.; 4-in., 42s.; 5-in., 48s.

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MAKERS: THE COALBROOKDALE COMPANY, SHROPSHIRE.

NAPHTHA.

THE Undersigned are prepared to give the highest market value for genuine crude COAL TAR NAPHTHA.

Address HAMILTON MACBEAN & Co., Blackhorse Bridge, Deptford, LONDON.

TO BUILDERS AND CONTRACTORS.

THE Directors of the Market Har-borough Gas Company are prepared to receive TENDERS for a GASHOLDER-TANK, 62 ft. in diameter and 18 ft. deep, to be constructed at the Gas-Works, Market Harborough.

Plans and specifications may be seen at the Works of the Company, or on application to Mr. John Eunson, C.E., Northampton.

Tenders addressed to the Secretary, endorsed "Tender for Gasholder-Tank," to be delivered on or before Saturday, March 24. By order,

JOHN LESTER, Secretary.

Market Harborough, March 2, 1877.

MELTON MOWBRAY GAS-WORKS.

TO BUILDERS, CONTRACTORS, AND OTHERS.

THE Directors of the Melton Mowbray Gaslight and Coke Company are prepared to receive TENDERS for the excavation and building of a Brick GASHOLDER-TANK, 83 ft. diameter and 22 ft. deep.

Drawings and specifications may be seen on application at the Works of the Company.

Sealed tenders to be forwarded on or before Ten o'clock on the 24th day of March inst., addressed to Mr. JOSEPH MILES, Clerk, Gas Office, High Street, MELTON MOWBRAY.

The Company do not bind themselves to accept the owest or any tender.

TO GAS ENGINEERS AND IRONFOUNDERS.

THE Salford Corporation invite Tenders for the supply and erection of the New CONDENSERS required at their No. 2 Gas Station, in accordance with the plans, specifications, and conditions which may be seen at the Lamb Lane Gas-Works, Salford.

The Corporation also invite Designs, Specifications, and Tenders for the supply and erection of WASHERS and SCRUBBERS for the same Station.

The Corporation do not bind themselves to accept the lowest or any tender.

Tenders, sealed and endorsed "Condenser," "Washer," or "Scrubber," as the case may be, are to be delivered to me on or before the 24th inst.

By order,

CHRIS. MOORHOUSE, Town-Clerk.

Town-Hall, Salford, March 12, 1877.

TO TAR DISTILLERS, MANUFACTURERS, AND OTHERS.

THE Directors of the Phœnix Gaslight and Coke Company are prepared to receive TENDERS for the purchase of the TAR made at their respective stations at Vauxhall, Bankside, and Greenwich, for the period of One, Two, or Three years from the 1st of April next. The quantities will be, approximately—Vauxhall, 1,000,000 gallons; Bankside, 280,000 gallons; and Greenwich, 360,000 gallons, in twelve months; total, 1,640,000 gallons.

Tenders may be made for one or more of the stations.

Forms of tender and conditions of contract may be had upon application to the Secretary, 70, Bankside.

Tenders, endorsed "Tender for Tar," to be delivered at this Office on or before Wednesday, March 21, at One o'clock p.m.

The Board do not bind themselves to accept the highest or any tender.

By order of the Court of Directors,

I. A. CROOKENDEN, Secretary.

70, Bankside, London, S.E., March 7, 1877.

EXHIBITION OF APPARATUS FOR COOKING AND HEATING BY GAS, OF GAS BATHS, GAS ENGINES, &c.

THE Directors of the South Shields Gas Company purpose to hold a PUBLIC and FREE EXHIBITION of the above nature in the FREE LIBRARY HALL, SOUTH SHIELDS, on the 9th, 10th, and 11th of April, 1877, when Seven Silver Medals will be awarded for the best Apparatus exhibited.

The following gentlemen have consented to act as Judges:—

John Pattinson, Esq., Analytical Chemist, Newcastle-upon-Tyne; W. H. Bennett, Esq., Civil Engineer, Secretary of the British Association of Gas Managers; to be assisted in testing Cooking Apparatus by a Professional Cook.

The co-operation of Manufacturers and others is invited.

An early application for prospectus and space is requested, and to be made to the Company's Engineer,

W. J. WARNER.

Gas-Works, South Shields, March 8, 1877.

SULPHATE OF AMMONIA.

WHY sell your Liquor when it pays you better to work it up yourselves?

Consult J. JUDGE, Chemical Plumber, Burner, &c., who has put up several sets for Gas Companies with success. Saturating Tanks, &c., made to order. Success sure, and nuisance got rid of.

No. 96, NEW ROAD, WANDSWORTH ROAD, S.W.

W. HAILES, Furnace Builder and Retort Setter, contracts for the Setting of RETORTS, in large or small works, at home or abroad. Sixteen years with the Commercial Company, London; Setter for the Isle of Thanet, Deal, Dartford, Brentford, and Wandsworth Companies, &c. The best Stourbridge goods supplied if required.

Address, 3, High Street, Brentford, MIDDLESEX.

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TAR DISTILLERS & MANUFACTURING CHEMISTS,

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BUYERS OF COAL TAR,

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AMMONIACAL LIQUOR, &c

YEO'S PATENT ENGINE PACKING.

By Her Majesty's Royal Letters Patent.

EPHRAIM YEO, Inventor, Patentee, and SOLE MANUFACTURER of the Patent Excelsior Self-Lubricating Rope Engine Packing; also Manufacturer of Improved Tarred and White Spun Yarn for Gas and Water Pipe Joints, Coke Sacks, Fall Ropes, &c.,

NEWTON ABBOT, DEVONSHIRE.

Samples and particulars forwarded on application.

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CLAYTON, SON, and CO. beg to call the attention of their friends to the fact that they have REMOVED from their Old Works in Belinda Street, Church Street, Hunslet, to their new place of business, PROVIDENCE IRON-WORKS, near the Railway Station, Moor End, Hunslet, Leeds.

Their New Works are much more commodious. In them they have put down improved machinery for the manufacture of Gasholders, Boilers, Roofs, &c.

C. S. & Co. take this opportunity of thanking their friends and the public for past favours, and trust they may be supported in the future. All orders entrusted to their care shall have their usual prompt and careful attention, and will be executed in the best workmanlike manner, as in the past.

GAS-WORKS CLAUSES AMENDMENT ACT, 1871.

ANNUAL ACCOUNTS OF GAS COMPANIES.

FORMS OF ANNUAL ACCOUNTS, arranged as required by the 35th Section of the Act (34 & 35 Vict., cap. 41), are now ready.

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SPECIAL ACCOUNTANT FOR GAS COMPANIES,
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Accounts analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.

The Forms of Account, which have been specially designed by A. L. to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, and have been universally approved.

The above forms are registered.

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TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

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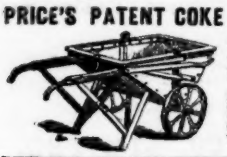
Information as to cost, &c, supplied gratuitously upon application to the Advertiser, 22, Great George Street, Westminster.

PRICE'S PATENT COKE & COAL BARROW



effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. Price, Inventor and Patentee, Gas-Works, Hampton Wick, Middlesex.

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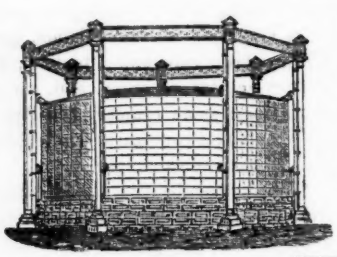

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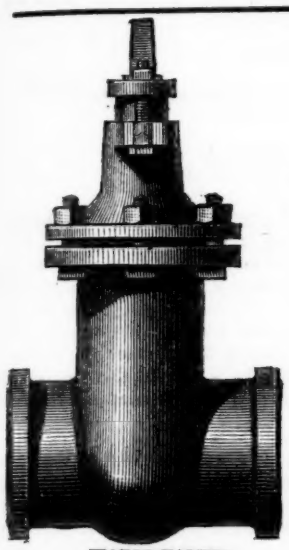

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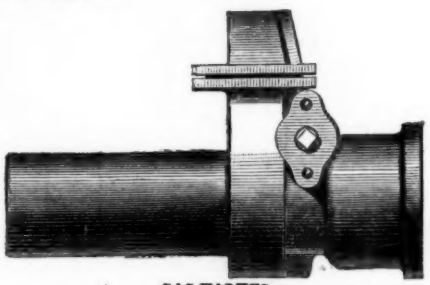

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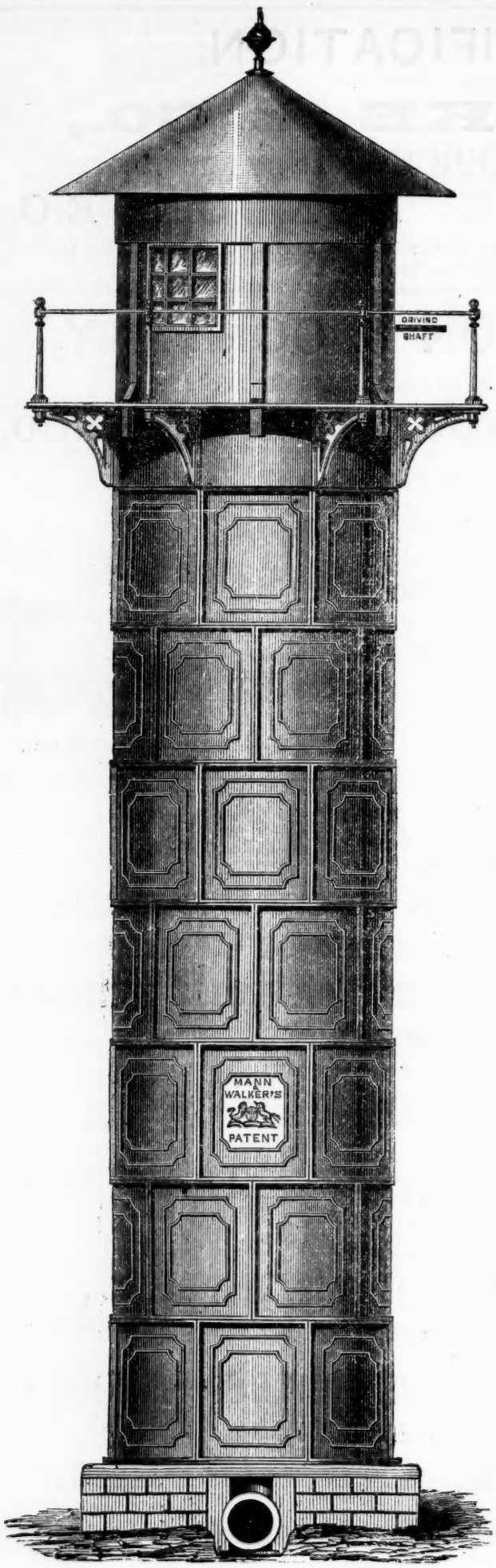
DESIGNS AND ESTIMATES SUPPLIED ON APPLICATION.



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MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, the number in use exceeds **one hundred,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

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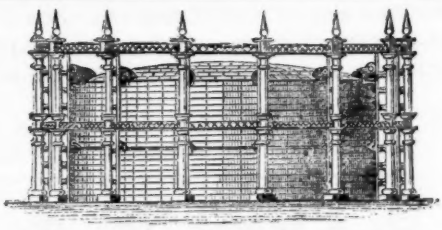

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Purified gas per ton of coal in cubic feet (average)	10,775
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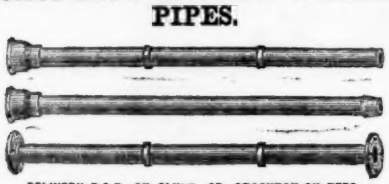

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The following are some of the prominent advantages of the BLAKE PUMP:—
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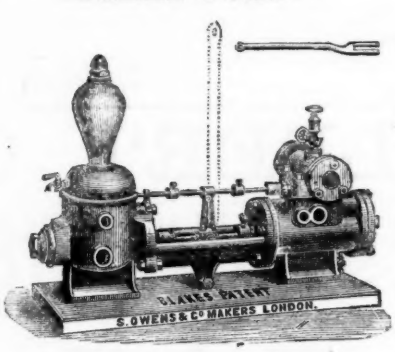

It is interchangeable in all its working parts.
It will deliver more water than any other pump.
It is made of best materials in the most workmanlike manner.
Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

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Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

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Yields 13,320 cubic feet of 32·5-candle gas per ton.

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POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

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T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,524 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

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REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

MESSRS. NEWTON, CHAMBERS, & CO.,

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NEAR SHEFFIELD,

STRONGLY RECOMMEND A TRIAL OF THEIR

CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.

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THE "RELIANCE,"

MANUFACTURED BY THE

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The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

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THE REFEREES PRESSURE GAUGE.

All the instruments of this kind which have yet been produced have been made under instructions from the Referees by ALEXANDER WRIGHT AND Co., inclusive of the model which was deposited on the 22nd of January last at the offices of the Referees, and received their approval. With that Gauge all others must in principle conform.

GAUGE ON WOOD STAND, 4-inch SCALE, AS PER MODEL ABOVE NAMED, 60s.

They will also be made without wood stands, suitable for placing on shelves, wall brackets, &c., and of different scale lengths and varieties to suit special requirements.

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